BFI Waste Systems of New Jersey, Inc.
1235 Westlakes Dr, Suite 310
Berwyn, PA 19312

April 15, 2021

Township of Monroe
Office of the Mayor and Utility Department
1 Municipal Plaza
Monroe Township, NJ 08831

Attention: Mr. Stephen Dalina, Mayor
Mr. Joseph Stroin, Utility Director

Subject: Leachate Reintroduction to Sanitary Sewer Plan

BFI Waste Systems of New Jersey, Inc.
Spotswood-Gravel Hill Road
Monroe Township
Middlesex County, NJ

Dear Mayor Dalina and Mr. Stroin:

Please find attached a report incorporating efforts taken by BFI Waste Systems of New Jersey, Inc. (BFI) and its consultants to assess the potential source of odors related to leachate discharge through the sanitary sewer and accompanying efforts to provide a safe means for reintroduction of leachate.

The Monroe Township Landfill (Landfill) discharged its leachate to the public sewer for decades almost without incident or complaint. Before 2020, only one odor complaint was received; the cause of the complaint was a defective trap in a residential laundry tub that was quickly repaired by BFI Waste Systems of New Jersey, Inc. (BFI).

Odor observations in 2020 were received in August and September leading to a meeting held September 23, 2020 to discuss landfill operations and current conditions. Discharge hours observed via remote monitoring were correlated with odor observations and discharge of leachate through the sewer was temporarily discontinued. Leachate has not been discharged through the sewer after September 23, 2020.

The data presented in this report represents the steps taken to identify the likely cause of odors in homes (Page 3), improvements made to the system to facilitate better control of the leachate discharge (Page 6), a proposed plan for safe, controlled reintroduction of leachate (Page 12), and an evaluation of the existing sewer (Attachment A).

After receipt of comments from the Township's consultant, Jacobs Engineering to the initial reintroduction memo from December 8, 2021 and the revised memo from January 6, 2021 (Appendix A), and the Environmental Protection Agency (EPA) (Appendix B), the plan was revised to include pressure and flow monitoring to analyze background flow as well as propose clean water injection testing to verify expected pressure and flow impacts upon reintroduction of leachate such that expected capacities of home sanitary sewer gas protection systems would not be compromised (Attachment B). Pressure and Flow monitoring equipment was installed February 5, 2021 in the sanitary sewer system. Information was analyzed to verify assumptions with background flow (Attachment C) prior to proceeding with clean water injection testing. Clean water injection testing was completed on February 17, 2021 and March 2, 2021.

Results from the clean water injection testing were reviewed and utilized to evaluate leachate reintroduction and a supplemental Leachate Reintroduction Plan (Attachment D) was submitted which establishes a daily background flow, or diurnal flow for the sanitary sewer and includes data observations from February 5, 2021 through March 2, 2021. Additional context for collected data from pressure and flow metering (Attachment E), associated graphs of this data for each manhole (Attachment F), and context for challenges observed during data acquisition (Attachment G). During clean water testing, the estimated pressure stress points for compromised home sanitary sewer gas protection were not observed at any of the tested flow rates. The pressures did increase as was expected with each increase of flow. Based on further comments from the EPA (Appendix C) and MTUD (Appendix D), additional monitoring will be conducted during reintroduction of leachate into the sanitary sewer.

Additional materials provided in this report are a site layout showing the leachate collection system (Attachment H), a Process and Instrumentation Diagram (PID) for the manholes and pump stations (Attachment I), and proposed improvements to the access road and tank containment area (Attachment J).

After thorough analysis, design, and internal and external technical review and comment, BFI has provided a solution for the safe reintroduction of leachate to the sanitary sewer, including enhancements to discharge, containment, and controls. All improvements are on schedule for reintroduction of leachate to commence as early as the week of April 26th.

If you have any questions, please contact me at jschmidt4@republicservices.com or (610) 576-2939.

Sincerely,

Jacob Schmidt
Area Environmental Manager

cc: Al Hemma
Sheena McCarthy

MEMORANDUM

TO: Jacob Schmidt

FROM: Bret Clements, P.E. (KS 22717), Christopher Woloszyn, E.I.T., Eric Peterson, P.E., Robert Gardner, P.E., and Michael McLaughlin, P.E. (VA 020671)

SUBJECT: Monroe Township Landfill Leachate Sewer Discharge

INTRODUCTION

The Monroe Township Landfill (Landfill) discharged its leachate to the public sewer for decades almost without incident or complaint. Before 2020, only one odor complaint was received; the cause of the complaint was a defective trap in a residential laundry tub that was quickly repaired by BFI Waste Systems of New Jersey, Inc. (BFI).

RECENT ODOR OBSERVATIONS

Odor observations in 2020 were first received by the Township on August 4, 2020. A series of emails from the Township and EPA led to an on-site meeting to observe the odors and to meet with residents.

On August 13, 2020, SCS met with USEPA representatives John Osolin and Pat Seppi at the Landfill regarding odor complaints from local homeowners. Approximately nine homeowners attended the meeting with SCS and EPA. Intermittent odors were reported to have been observed in early August. SCS and USEPA spoke with Monroe Township Utility Department's Robert Noel regarding flows and the history of the neighborhood.

On September 16 and 17 residents observed additional odors and reported them to the Township's office. These events led to the Township's September 23 meeting with all involved parties to review Landfill operations and current conditions. That evening, after the Township meeting, odors were again observed and reported by the residents. No leachate has entered into the sewer system since that evening.

On September 26, BFI contracted with a liquid waste hauler to transport leachate offsite to be disposed at a wastewater treatment facility.

Odor reports related to odors entering residences from the sewer system are believed to be limited to residences on Michelle Street and a house east of Michelle Street on Lori Street. Since discontinuing the discharge of leachate into the sewer system, no odor reports have been reported at the homes near the landfill.

RECENT CHANGES IN LEACHATE MANAGEMENT

Due to the aforementioned odors (believed to be infiltrating homes through the sewer system), discharges of leachate from the Landfill to the sewer system have been discontinued since September 23, 2020. Instead, tanker trucks currently are hauling leachate to Chester, Pennsylvania (75 miles one way) and to Baltimore, Maryland (157 miles one way). During several wet weather events, MTUD allowed trucks to be discharged at the Monroe Township Utility treatment facility. The facility is hoping to begin hauling leachate to the Passaic Valley facility in the near future.

The change to hauling leachate by truck came during October and November, which are historically the months with the fewest gallons of leachate generated at the Landfill, see Figure 1. Relatively few trucks (up to eight per day) were needed to haul leachate in October and November. Generally, March has seen the highest volumes of leachate, by a factor of 3.5 to 4 compared to October/November volumes. This will correspond to an increased number of trucks per day that will be needed to haul leachate to a wastewater treatment plant, if leachate is unable to return to the sewers soon.

The operational goal while trucking leachate from the site is to keep the leachate underground storage tank (UST) at the landfill as close to empty as is practical (to reduce the potential for overfilling the UST). To this end, five additional temporary above ground storage tanks have been added near the site entrance, and four additional tanks have been mobilized near Pump Station B, to increase the site's ability to store leachate between trucking of loads offsite. All tanks are now 21,000-gallon capacity. See the summary on page 9 for details on the tank mobilization timeline.

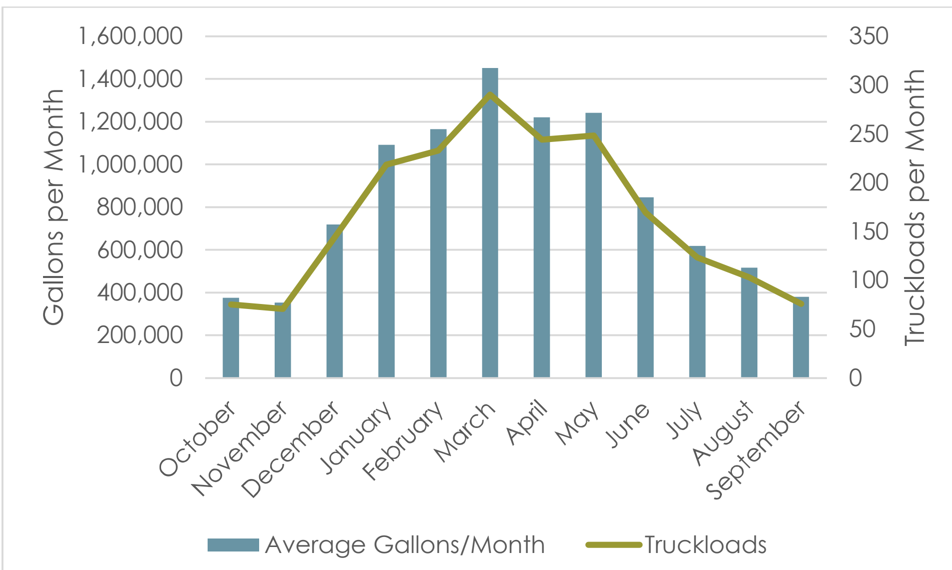


Figure 1. Average Monthly Leachate Production, 2013-2019

The landfill generates 10 million gallons of leachate in the typical year. To carry that much leachate in 6,000-gallon tanker trucks would require 1,667 tanker truck trips each year. If each truck travels 100 miles round trip and trucks average 6 miles per gallon, that is about 28,000 gallons of fuel—and more than 250 metric tons of carbon dioxide-equivalent greenhouse gases—every year, just to haul leachate. Discharging leachate directly to the sewer reduces the potential for accidents and spills, reduces truck traffic on neighborhood streets, reduces degradation of residential streets, and produces fewer greenhouse gas emissions.

LEACHATE QUANTITY AND QUALITY CHARACTERISTICS HAVE NOT CHANGED

In the first eight months of 2020, the landfill discharged 7.9 million gallons of leachate to the sewer. This is a little less (3% less) than the average amount of leachate discharged from the landfill in the January through August period since 2013—in other words, leachate is being produced in 2020 at about the same rate as the last seven years. Similarly, the chemical characteristics of the leachate have remained about the same over the last three years.

ODOR SOURCES

Odor reports from several home owners indicated that odors were suspected of entering their home through their sewer systems. The most likely explanation for these odors is that surges of leachate displaced sewer gases through plumbing traps in affected homes. The small concentrations of aromatics in the leachate might be a secondary factor, and might explain a more chemical-like (as opposed to a sewage-like) odor.

Since discontinuing the discharge of leachate into the sewer system, the only odors reported (via comments during the public meeting) have been limited to the street and sidewalk near the landfill driveway.

- Residents and other personnel who have reported odors along the streets and sidewalks were likely observing odors from one of the Landfill's temporary leachate tank vents.
- Odors are most likely to occur when the tanks are filling up with leachate as the air from the tank is being pushed out of the tank as it fills. The operational staff are making changes to keep these vents as closed as possible. However, these vents cannot be fully closed off while they are being filled or emptied as it may damage the tank.
- The Landfill intends to remove these temporary above ground storage tanks after resuming leachate discharge to the sewer at sufficient capacity.

SPECIFIC ODOR EVENT ASSESSMENTS

<u>August 4-13, 2020 - 1st Series of Intermittent Odor Events being reported</u>

There is no continuous flow graph available for this period. However, the pumping records for this period were reviewed and there was no indication of an abnormal event.

The exact time and locations where the odors were observed on these days is unknown. The amount of sanitary sewer usage during these periods of observed odors is also unknown.

<u>September 16, 2020</u>

Monroe Township was able to provide the continuous flow monitoring records for 9/16/20. A snip of it has been provided as Figure 2, which documents the discharges from the UST to the sanitary sewer system on September 16, 2020. The records indicate the UST Pump was working as follows:

- 12:00 AM - 11:30 AM - 80 gallons per minute (gpm) for 6-8 min. durations with about 2 hrs. between cycles.
- 11:30 AM - 2:30 PM - 80 gpm for 12-23 min. durations with 5-8 min. between cycles
- 3:00 PM - 11:59 PM - 85 gpm for 51-83 min. durations with 15 min. between cycles

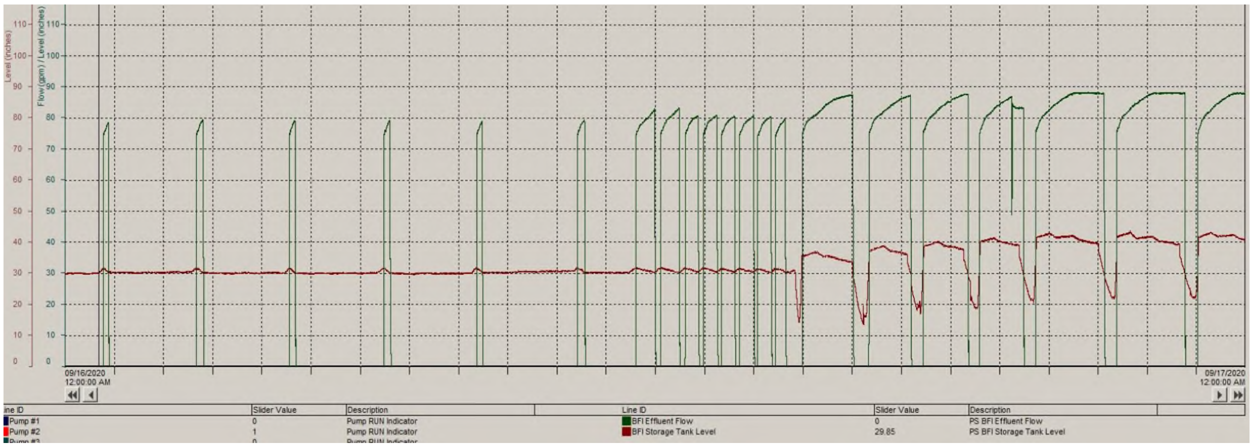


Figure 2. Snip from 9/16/2020 Flow Discharge from UST (Provided by Monroe Township)

The exact time and locations where the odors were observed on these days is unknown. The amount of sanitary sewer usage during these periods of observed odors is also unknown.

However, the following maintenance activities occurred at the landfill on this date:

9/16/2020	The pump that discharges to the UST was replaced. This likely lead to the change/increase in pumping rate at 2:30 in the afternoon.

<u>September 17, 2020</u>

In addition, there were pump activities on the following day at the AB sump involving the removal of a blockage from one of the pump discharge pipes. This likely resulted in additional liquids being freed up to be discharged at a higher rate than had been previously discharging. There is no continuous flow graph available for this period.

<u>September 23, 2020</u>

Monroe Township was able to provide the continuous flow monitoring records, a snip of which has been provided as Figure 3. Figure 3 documents the discharges from the UST to the sanitary sewer system on September 23, 2020. The records indicate the UST Pump was working as follows:

- 12:00 AM - 2:30 PM - 80 gpm for 8-9 min. durations with about 2 hrs. between cycles.

- 2:30 PM - 6:10 PM - 80 gpm for 15 min. durations followed by 65 gpm for 2.5 hr period; pausing for a half hour, and then pumping 80 gpm for 18 minutes before being turned off.

The exact location where the odors were observed on this day are unknown. At least one odor report was believed to have been observed around 5:30 PM, which corresponds to one of the longer durations of pumping. The amount of sanitary sewer usage during these periods of observed odors is also unknown.

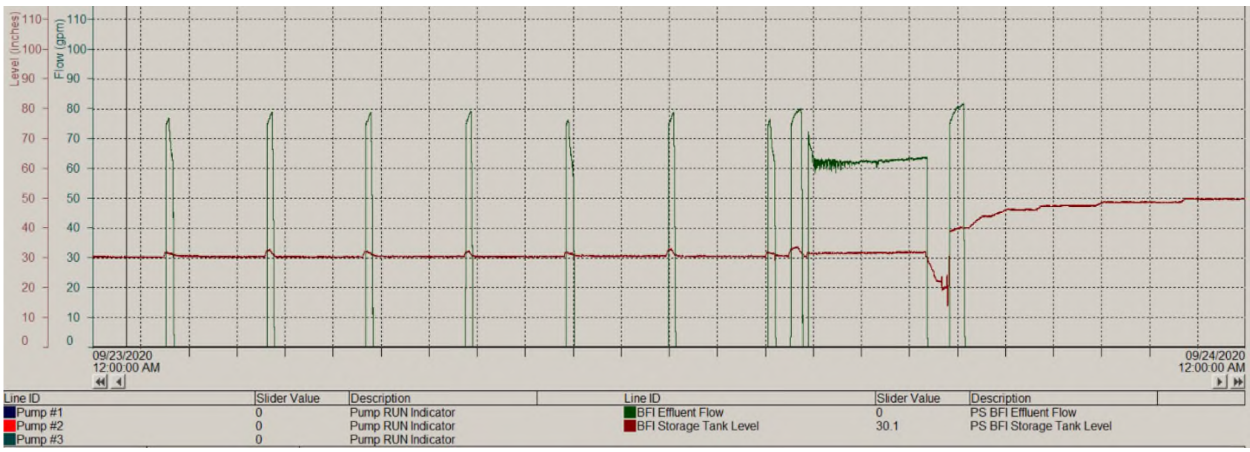


Figure 3. Snip from 9/23/2020 Flow Discharge from UST (Provided by Monroe Township)

SCHEDULE TO RESUME DISCHARGE TO SEWER

Resuming discharges of leachate to the sewer as soon as possible is important for the reasons previously summarized, and because the volume of leachate generated by the Landfill is expected to increase significantly between December 2020 and March 2021 (see Figure 1 above). Should increases in leachate volume occur before leachate is returned to the sewer system, more truck traffic through the neighborhood will be required.

Prior to discharging leachate back into the sanitary sewer system, the Landfill will first begin an initial monitoring period to document the background pressures and flows (i.e., when the landfill is not contributing to the sewer system). The Landfill will then perform an initial clean water injection test as proposed in **Attachment B.** Following the clean water injection test, the Landfill will submit a plan to reintroduce leachate into the sewer system that will allow safe pressure and flow to be maintained within the sewer system.

PUMP IMPROVEMENTS

Recent modifications to the leachate UST pump and controls have been implemented. These modifications include addition of a variable frequency drive (VFD) to allow different flow rates for the leachate discharge. The controls modifications also include provisions for remote access to the data and the pump controller. This effort will be completed in mid-January. These remote controls will allow the landfill to immediately reduce the leachate discharge rate or temporarily cease flows to the sewer system if issues arise.

The UST pump previously operated at only one speed—leachate into the sewer was either full on at approximately 80 gpm or full off. As noted above, improved pump controls will allow leachate to be discharged at different rates. The discharge flow rate of the pump will be adjusted to account for the normal levels of sanitary sewer expected throughout the day. The goal is to keep any changes in the liquid levels in the sewer gradual and to not cause pressurization events within the sewer system. The variable speed controls will help the Landfill adjust pumping rates to be compatible with the variable contributions from residential properties in the sewer system. Based on the range of discharge rates determined to be acceptable into the sewer, calculation will be performed to determine if additional storage capacity is needed at the landfill.

SITE HISTORY

The Landfill is a closed landfill owned by Monroe Township (Township), New Jersey. The Landfill was operated for 23 years, from 1955 to 1978, covering 86 acres before its closure. The Township operated the landfill for the first 13 years until 1968 when it was leased to Princeton Disposal Service. In 1972, the company now known as BFI Waste Systems of New Jersey, Inc. (BFI), currently a subsidiary of Republic Services, Inc., acquired Princeton Disposal Services. BFI maintains the closed Landfill with onsite operations conducted by SCS Engineers and SCS Field Services (SCS) and other subcontractors.

In 1979 the state of New Jersey ordered the Landfill to undergo closure and required installation of a liquids collection system after leachate outbreaks occurred in 1978. The Landfill was placed on EPA's National Priorities List (NPL) in September 1983. It was removed from the list in February 1994. Since that time, the U.S. Environmental Protection Agency (EPA) has conducted five "Five Year Reviews."

The Landfill has continued safe operations since its removal from the NPL in 1994. Prior to the summer of 2020, only one previous complaint of odor was reported to BFI. This particular complaint was related to a malfunctioning trap in a residential laundry room that, once repaired, eliminated the odors for the residence. Including the years prior to the removal from the NPL, the Landfill has maintained over 40 years of compliant operations.

EPA REVIEW OF LANDFILL

Five-Year Reviews provide EPA an opportunity to evaluate the implementation and performance of a remedy to determine whether it remains protective of human health and the environment. The last review was conducted in 2019. In the latest EPA review the following was noted:

Site Inspection: "No significant issues were identified during the inspection. All the engineering controls appeared intact and in good condition".

Protective Statement: "The remedy at the Monroe Township Landfill site is protective of human health and the environment".

LANDFILL LIQUID CONTROL INFRASTRUCTURE

Under typical operations, the Landfill collects liquids through underground perforated piping and discharges them into the AB Sump. Liquids are pumped out of the AB Sump into the UST. From the UST, a level-controlled pump periodically pumps the liquids out of the tank and into a pipeline that flows through the flow meter. After passing through the flow meter the liquid discharges into the sanitary sewer system. See Figure 4 for a site layout.

The Township has direct (remote) access to the data recorded by the flow meter.

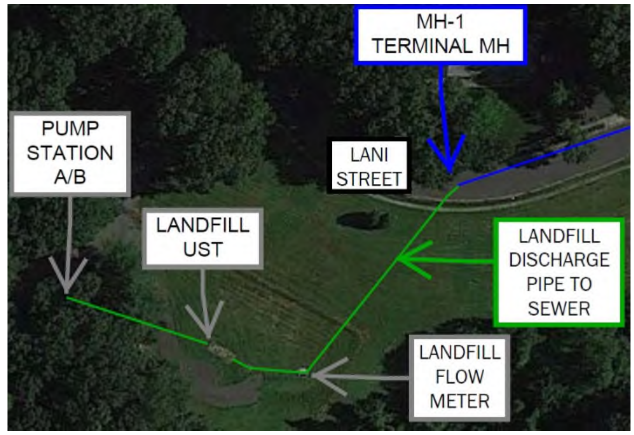


Figure 4. Landfill Leachate Discharge Site Layout

SANITARY SEWER INFRASTRUCTURE

As shown on Figure 5, downstream from the flow meter, liquids are discharged into the Township's sanitary sewer system. Liquids travel in an 8-inch pipe that gravity drains east along Lani Street. Several homes along Lani Street and Guinevere Road discharge into this sewer line. Ultimately, this line flows to a manhole (MH-4) located at the intersection of Lani Street and Michelle Street. This manhole also collects liquids from homes along Launcelot Lane.

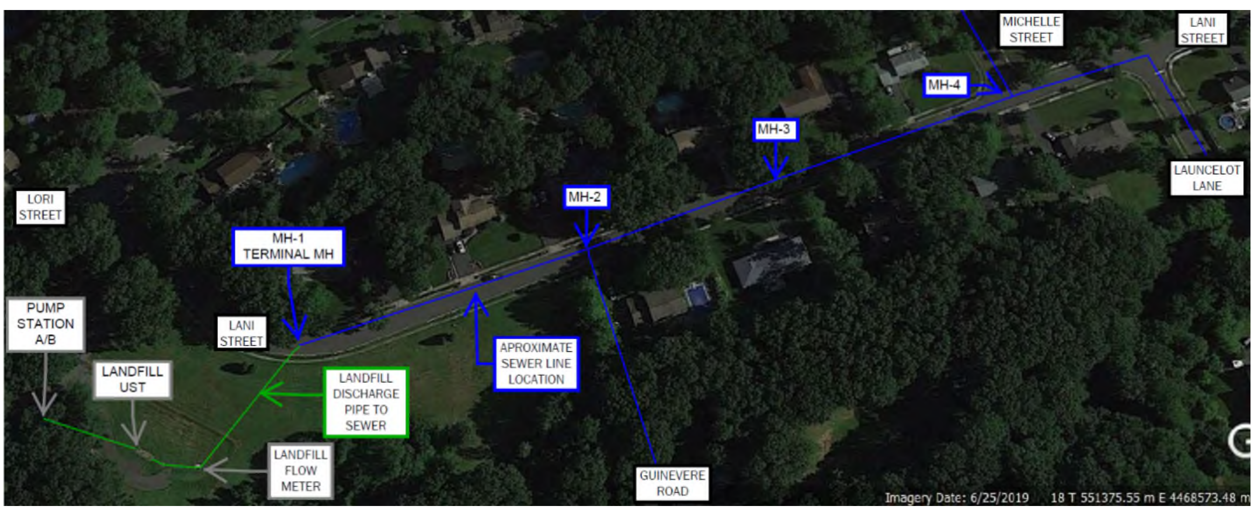


Figure 5. Landfill Discharge to Sewer Pipe from MH-1 to MH-4

From MH-4 an 8-inch gravity sewer flows north under Michelle Street through additional manholes (MH-5 and MH-6). Homes on either side of Michelle discharge into this sewer line. Ultimately, this 8-inch pipe discharges into a manhole (MH-7) located at Lori Street and Michelle Street.

Because a number of residents along Michelle Street reported odors from the sewer, this section of the sewer system was the focus of analysis and inspection by SCS and the Township.

The sewer pipe beneath Michelle Street from MH-4 to MH-5 had the steepest slope of the pipes reviewed as part of this assessment: nearly 4%. The slope of the pipe from MH-5 to MH-6 was flatter at about 1% and from MH-6 to MH-7 became even flatter at about 0.5%.

Also of note is that at MH-5, the first manhole north of Michelle Street and Lani Street, there is a relatively steep slope of liquid within the manhole (the influent sewer pipe is above the bottom of the manhole). Both of these factors (steep slope feeding the manhole and steep slope within the manhole) likely create turbulent conditions. Turbulent flow can cause vaporization and atomization of volatile compounds, increasing the likelihood of odorous compounds escaping sewer liquids. During the proposed clean water injection test, increased headspace pressures will be closely monitored at MH-5 and MH-6 due to the flatter slopes on the subsequent sewer reaches.

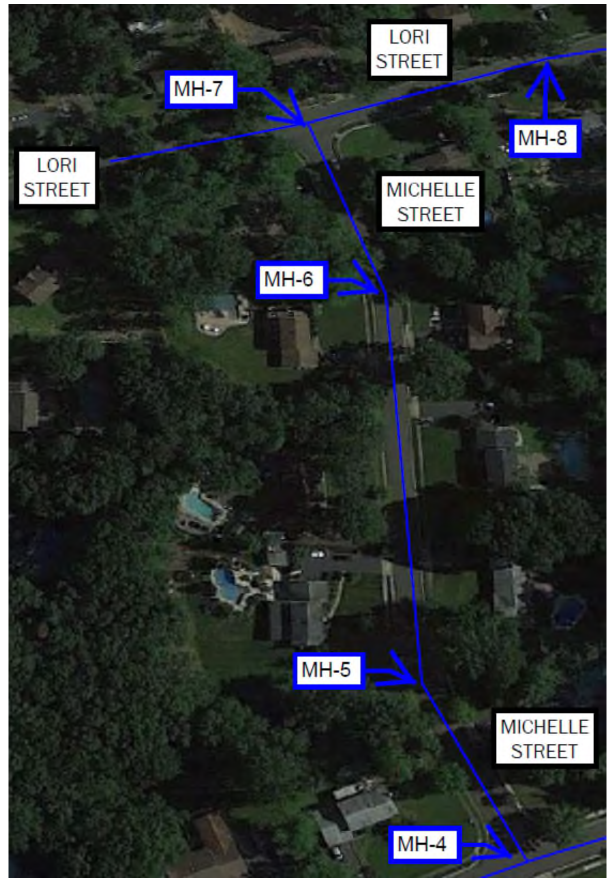


Figure 6. MH-4 through MH-8 Site Layout

Once sewer liquids from Michelle Street are discharged into MH-7, the manhole at Michelle Street and Lori Street, the liquid is mixed with any liquids that are being conveyed by the sewer line that is serving Lori Street west of this manhole. The co-mingled sewage in this manhole is then discharged to an 8-inch pipe that drains the liquid east along Lori Street. The video inspection of this sewer, conducted on October 13, revealed that there are multiple homes along Lori Street discharging into this line. During video inspection of the sewer, the sewer pipe beneath Lori appeared to have cobwebs on the crown of the pipe, indicating that high flows are not regularly observed along this reach.

Figure 7. MH -7 Discharge to Lori Street through MH-9

TIMELINE AND SUMMARY OF INVESTIGATION AND RESPONSE ACTIONS

Date	Investigation and/or Response Action
9/23/2020	Evaluated pump operations and discharge into sewer system; last day the Landfill discharged into public sewer system
9/26/2020	Landfill commenced use of tanker trucks to haul liquids to wastewater treatment plant.
10/1/2020	Public Meeting
10/8-9/2020	Cleaned AB Sump, Discharge lines from UST to sewer, and other on-site sewers feeding the AB Sump. This cleaning is required by the facility's permit.
10/13/2020	MTUD inspected select sewer lines along Lani and Lori Streets and all of Michelle Street.
	An evaluation of the sewer size has been provided in Attachment A. Attached to this memo are calculations showing that the sewer system is sufficiently sized to handle both the design residential sewer system loading event at diurnal peak flows plus the Landfill's liquids.
10/19/2020	Collected Air and Liquid Samples at UST to try to identify cause of odor.
	The Landfill contracted with a toxicology specialists, Stantec, to evaluate its leachate and to try to identify components within the leachate that may be causing the chemical smell. Chemical smells are quite often associated with Volatile Organic Compounds (VOCs). VOCs get their name because of their ability to volatilize out of liquid and emit into the air.
	Stantec collected air and liquid samples at the underground storage tank (UST) which is the final location for leachate to be stored on-site prior to being discharged to piping which flows through the metering station. After the flow metering station the station then discharges the liquid into the sanitary sewer system at the termination manhole on Lani Street. See the Stantec report for results and additional information.
	In Summary and Conclusions of the Stantec Technical Memo, it is stated that the odors detected above American Industrial Hygiene Association odor thresholds could be consistent with the residents' complaints of "turpentine" or "acetone" odors.
10/22/2020	Made improvement to the storm water channel located outside the fence to clear the channel of trees and vegetation; old stone and vegetation were deposited on landfill; new stone was installed.
10/26-30/2020	Mowing and site maintenance were completed as required by the Site's Permit.

Date	Investigation and/or Response Action
10/30/2020	MTUD provided a link to the sewer inspection video completed on October 13, 2020. The camera inspection revealed that the monitored pipes appear to be in working order as no significant damage was observed. The pipe along Lori Street did not appear to be receiving flows that exceeded approximately 50% of the pipe capacity as spider webs were observed in the upper half of the pipeline. Flows along Michelle Street appear to be at least periodically using more than 50% of the pipe's capacity. It is unclear what caused the flows within the sewer line to exceed the design flow levels. Flows in excess of the design levels may contribute to elevated pressures which may cause odors being to be emitted to homes. Installed the first of two 21,000 gallon tanks to provide additional capacity and flexibility in matching liquid generation and discharge to sewer.
11/3/2020	A variable frequency drive (VFD) was installed in the UST pump control panel. This improvement will allow the facility to adjust the rate at which the pump discharges leachate to the sewer system. Previously the pump would operate at maximum capacity anytime the pump was turned on. The VFD will also allow the site to gradually increase the pumping rate for each start up event, which will also reduce the potential for immediate pressurization to occur during pump startup events.
11/4/2020	UST was cleaned out, completing the cleaning from 10/9/20.
11/5/2020	Additional liquid sampling occurred on-site. This additional sampling is being completed to try to identify the source of the potential odor causing compounds or determine if it was occurring near the UST.
11/6/2020	Gravel placement on site access road, expansion and grading. This will help aid in minimizing the amount of mud tracked onto the township's roads.
11/10/2020	Conducted first smoke test at resident's home. No smoke was found within the living area of the residence. It also was reported the vent in this residence was not functioning properly.
11/11/2020	Additional air and liquid sampling was completed at the UST and other key structures on the site. Installed the second of two temporary 21,000-gallon tanks to provide additional capacity and flexibility in matching liquid generation and discharge to sewer.
12/2/2020	Additional liquid sampling was completed at the UST.
12/11/2020	Installed hard piping from UST to two above-ground tanks for protection against freezing

Date	Investigation and/or Response Action
12/24/2020	Surcharge of liquids at Manhole 10, upstream of PS B. Emergency response team (First Call Environmental) mobilized to deploy oil booms and absorbent material along fence perimeter and along ditch outside of property. MTUD (Jet/Vacuum Truck and Crew) assisted with removing liquid from PS B.
12/25/2020	Surcharge of above-ground storage tank due to high flows during rain event. Cleanup on 12/26 included deployment of absorbent material. Emergency response team on site to assist with cleanup and to check MH-10 absorbent material.
12/28/2020	Second surcharge of MH-10. MTUD again assisted with removing liquid from PS B via vacuum truck. Emergency response team on site to assist with cleanup and deploy additional adsorbent materials around MH-10.
12/29/2020	DEP, EPA, MTUD, BFI, and SCS on site to review surcharge events and to evaluate site condition. Delivery of 11 temporary storage tanks to assist with removing liquids out of PS B and MH-10. Start of 24-hour observations and pumping at PS B and MH-10 to on-site storage tanks.
12/30/2020	Third temporary tank delivered to front of site to supplement two existing tanks. Start of second hauler company with transportation and treatment at Baltimore, Maryland treatment facility.
12/31/2020	Fourth temporary tank delivered to front of site to supplement three existing tanks. Second hauler company delivered two loads to MTUD's receiving facility. Second hauler focused on removing liquids from tanks near PS B.
1/4/2021	Smaller tanks were swapped for larger tanks near PS B. Daily trucking quantities increased.
Early February	Facility will be upgrading the site's SCADA system for the discharge pump and remote monitoring capabilities. This will allow the facility to program the pump system to discharge at specified rates at various times of the day as necessary. Select leachate collection pipes will be cleaned and pumps will be serviced.

SAFE REINTRODUCTION OF LEACHATE

As summarized above, BFI evaluated several factors and completed response actions and upgrades to prepare to return to discharging liquids to the Township's sewer system, including retrofitting the Landfill's existing UST pump with a VFD and controlled by a SCADA system. These modifications will allow operators to program the UST pump to discharge at the rate desired depending on the time of day. The VFD will be set to gradually increase flow each time the pump turns on, rather than going from 0 gpm to approximately 80 gpm almost instantaneously. Reducing the rate at which the site discharges liquids, during increased residential flow periods, will also have the beneficial result of reduced headspace pressure and turbulence, thereby reducing the potential for leachate odors exiting the sewer.

Prior to reintroduction of leachate to the sanitary sewer system, the Township's sewers will be cleaned between MH-1 through MH-8 to remove any buildup in the sewer system. Next, a monitoring period will be conducted to establish background conditions in the sewer system without landfill leachate contributions. Finally, clean water injection testing will be performed. Please see Attachment B for further details. Once these tests are completed, a leachate reintroduction protocol will be proposed for consideration.

RESIDENCE INSPECTIONS

Residents that have detected odors from the sewer system should contact a plumber to evaluate their sanitary sewer system. A properly functioning home sanitary sewer system with proper vents and traps will aid homeowners in protecting their homes from odorous sewer gases.

DIURNAL FLOW DISCUSSION

Residents of a particular neighborhood are known to use water in their daily activities. Since a significant proportion of the water use in each household is discharged to the sewer system, monitoring sewer flow in a neighborhood sewer can be generally representative of the combined behavior of the population served. What was considered "normal" behavior in neighborhoods prior to 2020 was reflective of a population where a significant portion of the residences left for work or school outside the home. Sewage flow from these neighborhoods would rise in the early morning hours as residents readied for work and fall off during the work/school hours, only to rise again in the evening when workers and students returned to their homes.

A flow pattern of rising flow in the morning, dropping off until evening when flow increases again, then falling off during overnight hours, is referred to a *diurnal flow pattern*. Diurnal sewer flow patterns, or normal daily rhythms, changed significantly once residents were encouraged to work from home, and participate in remote learning. Monroe Township reports the diurnal rhythm of sewer flow prior to 2020 included a peak flow in the morning and again in the evening. However, under COVID-19 conditions sewer flow patterns are characterized by sustained flow throughout the day and less flow in the hours when residents are sleeping, without significant peaks or valleys.

Other factors can impact peak sewer flowrate, including activities, such as water softener flush/recharge or pool draining/filtering that is subsequently discharged to a sanitary sewer. Sewer systems subject to wet weather influences like infiltration and inflow from leaky sewers and manholes can also bring peak flows into sewers during wet weather events. These activities and events have the potential of creating conditions that limit what capacity is available at any time for landfill discharges to the sewer system. Since the landfill and residents must share the sewer system, it is important to understand the sewer use pattern of the neighborhood so the landfill flows can be accommodated without negatively impacting residents and vice versa.

APPENDIX A

Response to Jacobs Engineering Comments

RECOMMENDATIONS FROM THE JANUARY 19, 2021 JACOBS MEMO (DEVELOP UNDERSTANDING OF CAUSES AND POTENTIAL SOLUTIONS)

Determine the current and future minimum/maximum/average leachate production rates at the landfill. Develop a sound basis for leachate storage and pumping requirements based on historical records, and on future projections of climate change predictions; including, rainfall intensity and duration. Compare actual leachate production to calculated leachate production; determine if the landfill cover is compromised and is allowing excess surface water infiltration into the landfill.

<u>Response</u>

> Historic leachate generation at the landfill was assessed to accommodate years of increased and decreased precipitation simulating potential climate related impacts to leachate generation. Leachate storage has been assessed and is discussed further in response to comment 4. Landfill cover maintenance is an on-going assessment as the landfill settles and is further discussed in comment 2.

Make improvements to the landfill to reduce the amount of leachate generated, including filling low spots and regrading. These landfill cover improvements should ensure that excess rainwater is conveyed to the site storm drainage system and does not have the opportunity to percolate through the landfill cover and generate excess leachate.

<u>Response</u>

> Cover maintenance and leachate minimization are an on-going assessment conducted at the landfill as part of the post-closure management through the facility permit. Settlement areas are identified during routine inspections and filled or regraded as appropriate. Landfill cover and leachate minimization does not have an immediate impact on reintroducing leachate into the sanitary sewer and is therefore being completed as part of the existing post-closure care requirements.

Effectively operate the landfill dewatering system to achieve the operational objectives; maintaining a lower groundwater elevation within the landfill as compared with external to the landfill and avoiding long leachate detention times (‘cooking’ times) in contact with the landfill contents which can increase the “strength” of the leachate making it more odorous.

<u>Response</u>

> Groundwater elevations are monitored routinely at the facility. As part of the initial remediation efforts, transects of monitoring wells within the landfill, along the containment wall, and outside the containment area are also monitored to verify an inward gradient of groundwater flow. The leachate collection system at the landfill is working in accordance with the remediation design.

Ensure the leachate collection tank has adequate buffer capacity for now and in the future to level out the amount of leachate that needs to be removed from the landfill during any time of the year and pumped to the sanitary sewer system.

Response

Improved containment and leachate storage have been approved by the responsible parties and are being constructed to facilitate additional temporary storage of leachate. Leachate disposal via trucking was assessed to provide an estimated volume of storage to manage increased generation due to weather or other operational impact. During trucking operations, daily generation is impacted by availability for disposal off-site (limited disposal weekends and holidays, increased disposal weekdays). The proposed additional volume was determined assuming leachate is able to flow through the sanitary sewer and manage expected maximum and minimum generation from the landfill. Any permanent storage alterations will be assessed and verified through NJDEP.

Upgrade the existing SCADA system to monitor all leachate pump operations, leachate storage tank levels, and integrate pump and level control schemes and set points for pumping rates and durations so they never exceed the thresholds determined from any modeling or field studies of the sewer system. This should include remote access to allow for data viewing and intervening to instantly reduce or temporarily cease leachate flows when required.

Response

SCADA improvements are being completed to provide additional monitoring and control of the leachate collection, conveyance, storage, and disposal system. BFI will be utilizing additional equipment within the sanitary sewer during initial leachate reintroduction to monitor pressure thresholds and make appropriate adjustments as needed.

Determine the maximum flowrate capacity of the existing sanitary sewer (both in maximum flow rate and duration) to prevent sewer capacity problems from generating odors in the sewerage collection system downstream of the leachate discharge point near the impacted homes. Considerations should be given to the following when further developing a detailed plan for reintroducing leachate flow into the municipal sewer system:

a. The local air pressurization of the sewer as a result of relatively large volumes of leachate (compare to sewage flows) when leachate discharges take place over an extended period. This should include considerations of the existing sewer infrastructure, including transition zones between sections of sewer mains with steep pipe slopes and flatter pipe slopes.
b. Preparation and analysis of sewer pipe models and sewer gas models to determine acceptable flow rates, flow duration sand acceptable sudden flow increases.

Response

Maximum flowrates capacity of the existing sanitary sewer was provided in the initial leachate reintroduction memo. Sewer flow modelling was completed to provide optimal flow rates which were proposed in clean water testing. To verify both maximum flow rate duration of flow, BFI proposed and installed pressure and flow monitoring equipment in the sanitary sewer. Pressure and flow monitoring equipment was also utilized to capture any real-life conditions impacting the sewerage system that may have otherwise been overlooked with sewer pipe models and sewer gas models. Monitoring equipment will be utilized during leachate reintroduction to identify potential local air pressurization as a result of large volume.

The installation of in-situ sewer flow, level and air pressure instrumentation to generate data that captures “baseline” sanitary flow, level and headspace pressure conditions without leachate present, and to generate data during leachate flow simulation activities (i.e., introduction of potable water into the sewer system under controlled conditions) and potentially “return-to-service” conditions when leachate is reintroduced to the sewer system. The intent is to create the opportunity to determine the optimal leachate discharge flow and time of day considerations under all future scenarios (including unusual conditions such as extended periods of heavy rain and operational upsets in managing the collection of the leachate at the landfill).This data should be generated by introduction of clean water (fire hydrant with backflow preventer) into the sewer system, simulating leachate flow from the landfill.

Response

Leachate reintroduction plan was revised to incorporate installation of pressure and flow monitoring for background, baseline sanitary flow as well as leachate flow simulation activities (Clean Water Testing). The reintroduction plan included varied discharge rates via hydrant connection with clean water to establish anticipated induced pressures from leachate discharge. Background sanitary flow and observed pressures from water testing were assessed to determine optimal leachate discharge flow and time of day for discharge. BFI recommends leachate initially be reintroduced to the sanitary sewer at approximately 45 gallons per minutes with continued pressure and flow monitoring to verify simulated conditions.

An updated leachate reintroduction plan was submitted by Republic on 1/6/21; Jacobs reviewed this memo. The updated leachate reintroduction plan considers many of the recommendations identified in the Jacobs 12/8/2020 memo and should be an acceptable approach to establishing a baseline for the leachate flowrate the existing sanitary sewer can handle without triggering excessive sewer air (de)pressurization causing odor nuisance in the residential neighborhood and homes along the sewer alignment that conveys leachate.

Response

We agree that this should be a safe and effective manner to evaluate the sanitary sewer system while protecting the Monroe Township residents and their homes.

The installation of local odor control measures along the sewer alignment that conveys leachate flow could be considered. Examples are the installation of an “air jumper” at potential bottleneck sewer locations, elevated sewer stack vents, or an odor control unit.

Response

Flow control is being incorporated into the discharge system to manage anticipated flow and pressure restrictions caused by bottleneck or other hydraulic impact conditions within the sewer. Monitoring equipment will be utilized within the sewer system to provide warnings of pressure concerns and adjust the discharge as needed.

If expected future leachate discharge flows and durations are higher than the determined maximum capacity of the sanitary sewer allows, consider installation of a new dedicated leachate force main from the landfill site to a discharge point in the larger downstream sewer along Spotswood Englishtown Road.

Response

Leachate discharge volume through the sanitary sewer is limited by permit through Middlesex County. After clean water testing analysis for pressure and flow, anticipated leachate discharge to the sanitary sewer should not surpass the maximum capacity of the sanitary sewer. If leachate cannot be managed into the sewer system with current sanitary sewer system infrastructure, BFI will investigate ideas like this as well as others.

RECOMMENDATIONS FROM REVIEW OF 12/2/20 SCS ENGINEERS MEMO

Clearly identify the operational issues at the landfill that were occurring during August and September 2020.

<u>Response</u>

The leachate pump was impacted by sediment preventing the pump from shutting off and causing sustained flow through the sewer.

Provide an analysis of the leachate pumping rates and pumping durations that occurred before, during, and after the August and September 2020 odor events.

<u>Response</u>

The leachate discharge pump previously discharged at a fixed rate (approximately 87 gallons per minute).

Pump operations before the events in August and September were representative of typical discharge operations. When the liquid within the underground storage tank (UST) reaches a certain elevation the pump automatically turns on to discharge liquid to the sewer. Once the liquid within the UST lowers to a certain elevation, the pump automatically turns off.

During the events in August and September, the pumping system ran for extended periods of time due to sediment impacts.

After the events in August, the pumps were cleaned and operated within typical discharge operations. After the events in September, pumping was ceased.

Clearly identify the cause(s) of the odor complaints that were encountered in August and September 2020.Relate the leachate pumping activities to the odor complaints. Include any other information that may be relevant, including; weather, etc.

<u>Response</u>

As was verified by Jacobs Engineering, (de)pressurization of the sanitary sewer is believed to be the cause of odor detections and subsequent complaints. Sustained flow at a rate of approximately 87 gallons per minutes was indicated as the likely cause of (de)pressurization.

Provide a solid basis for a proposed plan to reintroduce leachate flow into the municipal sewer system that eliminates the possibility of residents being exposed in their homes and neighborhood to odors generated from discharge of the landfill leachate to the sewer system.

<u>Response</u>

Leachate has been safely managed through the sanitary sewer system for many years. Leachate discharge through a sanitary sewer is a common practice in landfill management and is a much safer process than other methods such as hauling leachate in tanker trucks. Assessment of the sewer system itself and potential impacts from leachate discharge and development of a plan for controlled leachate reintroduction is essential for management of the landfill leachate.

Considerations should be given to the following when further developing a proposed plan for reintroducing leachate flow into the municipal sewer system:▪The local pressurization of the sewer as a result of relatively large volumes of leachate (compare to sewage flows) when leachate discharges take place over an extended period, when leachate flow rates are “high”, and when other sewer conditions exist that can contribute to sewer surcharging.

<u>Response</u>

An assessment of the existing sewer system to identify contributing factors to flow or pressure limitations was proposed and completed.

A leachate reintroduction plan was developed, submitted, and has been revised incorporating flow simulation, pressure and flow monitoring of background sewer conditions, pressure and flow monitoring of clean water discharge simulating leachate flow, and recommendations for leachate reintroduction within thresholds for flow and pressure with accommodations made for potential surcharging flow through the sanitary system.

The installation of in-situ sewer flow/level/pressure instrumentation to generate data that captures the “baseline”, and to generate data during simulation activities and potentially return-to-service conditions. The intent is to create the opportunity to determine the optimal discharge conditions under all future scenarios (including unusual conditions such as extended periods of heavy rain and operational upsets in managing the collection of the leachate at the landfill), and avoid conditions that generate odors and sewer pressurization.

<u>Response</u>

Pressure and Flow monitoring devices were installed and data was reviewed for extended periods of activity to capture typical background flows as well as any unexpected background events contributing to surcharging flow through the sanitary system. Leachate discharge flow rates were recommended based on the observed background flows.

The introduction of clean water (fire hydrant with backflow preventer) into the sewer system, simulating leachate flow from the landfill.

Response

Clean water testing was recommended and completed to simulate and verify anticipated pressure and flow impacts from leachate discharge at varying discharge rates. Information gathered from clean water testing was used to further revise recommended leachate discharge rates through the sanitary sewer.

The installation of local odor control measures along the sewer alignment that conveys leachate flow. Examples are the installation of an “air jumper” at potential bottleneck sewer locations, elevated sewer stack vents, or an odor control unit. The ability to increase the amount of on-site leachate storage for capacity buffering to limit peak discharge rates from the landfill into the sewer.

Response

Flow control is being incorporated into the discharge system to manage anticipated flow and pressure restrictions caused by bottleneck or other hydraulic impact conditions within the sewer. Monitoring equipment will be utilized within the sewer system to provide warnings of pressure concerns and adjust the discharge as needed.

Temporary on-site storage was assessed and approved by the responsible parties. Permanent on-site storage will be assessed and any changes will be verified through NJDEP

Making improvements to the landfill to reduce the amount of leachate generated, including filling low spots and regrading.

Response

Cover maintenance and leachate minimization are an on-going assessment conducted at the landfill as part of the post-closure management through the facility permit. Settlement areas are identified during routine inspections and filled or regraded as appropriate. Landfill cover and leachate minimization does not have an immediate impact on reintroducing leachate into the sanitary sewer and is therefore being completed as part of the existing post-closure care requirements.

APPENDIX B

Response to EPA Comments

EPA COMMENTS TO MONROE TOWNSHIP LANDFILL LEACHATE SEWER DISCHARGE MEMO DATED JANUARY 6, 2021

General Comment:
An important objective of the clean water test should be to prevent sewer gases from entering homes during the test. The plan indicates an objective of the clean water test is to determine a rate of water flow that does not compromise home sewer gas protection systems by exceeding 75% of two inches of water column (in of w-c). Please provide an explanation of how the information provided by the pressure transducers will be monitored during the test to prevent exceedance of the threshold level, 75% of 2 in of w-c, and prevent sewer gases from entering residences during the test.

<u>Response</u>

The pressures recorded during each prior test (background monitoring, Clean Water Injection 1st Flow Rate, Clean Water Injection 2nd Flow Rate, etc.) will be reviewed for observed pressure increases. If pressures begin to approach the permissible pressure allowance, then if necessary the proposed incremental flow rate during clean water testing will be reduced to prevent exceeding the permissible pressure allowance.

The sewer is being jetted prior to testing and the testing plan initially will be using clean water injection. The lowest flow rate is planned to start at 45 gpm. Background flows during this period are currently estimated around 18 gpm, which means the sewage water would be diluted with 2.5 gallons of clean water for each gallon of sewage water. This diluted water is expected to have a low odor emission.

In addition, as discussed in the revised memo each household with a properly primed 2-inch P-trap is actually expected to have protection from sewer gases up to a pressure of 4 inches of w-c.

Page 2, first paragraph, last sentence: revise the sentence to acknowledge that trucks are/were utilizing the Monroe Township Utility facility.

<u>Response</u>

This has been revised.

Page 2, third paragraph, fourth line of paragraph: delete the word “near” from this phrase in the sentence “and ten additional tanks near have been mobilized…”

<u>Response</u>

This has been revised.

Page 2, third paragraph, last sentence of paragraph: modify the sentence to state "See the summary, on page 9, for details on the tank mobilization timeline."

Response

This has been revised.

Page 6, first paragraph, last sentence: The last sentence of the paragraph states the overall goal of the test which is to keep any changes in the liquid levels in the sewer gradual and to not cause pressurization events within the sewer system. Please add that it will also be the goal to determine how leachate pump rates will be adjusted to manage variable sewer line contribution from residential properties and determine if additional leachate storage capacity will be needed at the landfill.

Response

This has been revised to state: The variable speed controls will help the Landfill adjust pumping rates to be compatible with the variable contributions from residential properties in the sewer system. Based on the range of discharge rates determined to be acceptable into the sewer, calculations will be performed to determine if additional storage capacity is needed at the landfill.

Page 10, 11/10/2020 entry: revise the sentence to indicate that, although no smoke entered the living space of the home, the vent in this residence was not functioning properly.

Response

This has been revised.

Attachment A, page 1, first paragraph, second line of paragraph: delete the second "solely" in the sentence.

Response

This has been corrected.

Attachment B, Page 3, second paragraph: before the test is started, will it be determined if there is adequate water in the traps of residential properties, particularly those that have previously reported vapors in their homes?

Response

This will be impossible for BFI to perform as many residents would not want other people entering their homes, especially with the COVID 19 pandemic still on-going. We recommend that when the Township notifies residents of the proposed testing plan that they at that time request residents place water in each of their traps throughout the home.

Attachment B, Page 6, Photo Ionization Detector (PID): while EPA acknowledges limited utility for PID during the clean water test, it is expected that a more detailed air monitoring plan be presented for reintroduction of leachate into the sewer.

Response

We will propose to have a PID unit on-site the initial days of leachate introduction into the sewer system. An operator will utilize a PID to check each manhole lid at least once during a leachate pumping period. The operator will document any VOC concentrations detected. These VOC readings will be compared to background and clean water flow conditions. We expect an increase in VOC emissions from the pressurized manholes. However, we expect the VOCs to dissipate when vented to the atmosphere through the manhole lid and then be further dispersed by natural wind currents and vehicle induced air currents. Therefore, it is not expected that people would be exposed to the levels of VOC detected by the PID at the manhole lid.

Attachment B, Pages 6 to 8, Clean Water Injection: explain how BFI is accounting for the contribution from sources other than the landfill during the test. For example, if the test is conducted during a low use period, the flow capacity available to the landfill may be overestimated.

Response

The landfill will utilize their flow meter to document the amount of liquid being discharged from their facility. Two flow meters will be installed in MH-4 to document the flows from east and west of this manhole. The flows coming from the west of MH-4 will of course include the flows being documented by the landfill's flow meter, so we will be able to calculate the amount of residential use during this period. The third temporary flow meter will be installed in MH-7 and will be documenting residential flow in addition to the Landfill's flow. All of these meters will be installed prior to testing so we have an idea of what to expect during testing. The meters will also be recording data during the test, so we will be able to review the flows after the completion of the test and determine the total sewer flow, leachate flow and calculate the residential flow.

The flow documented in MH-7 will be used to compare with the pressure transducers along Michelle Street, and if significant pressures are observed, it will be determined to have happened at the total sewer flow operating at the conditions measured in MH-7. A similar method would be completed to determine the flow at which adverse conditions are created west of MH-4 along Lani.

Further, the flow meters and pressure transducers will be installed prior to clean water testing, so we will be able to review the range of total flows the sewer experienced during these background periods and see if these peak flows caused any concerning pressure events. This background period will also provide an idea of expected residential usage throughout various times of the day and we will be able to adjust the clean water testing and leachate introduction plans to adjust for the expected flows during each hourly period. If an unexpected spike or decrease in residential usage occurs during these periods, then it will be documented by at least one of the three temporary flow meters.

APPENDIX C

Response to EPA Comments

RESPONSES TO EPA COMMENTS ON LEACHATE REINTRODUCTION PLAN FOR THE MONROE TOWNSHIP LANDFILL

Prolonged pumping of leachate at a rate of 80 to 85 gallons per minute (gpm) raised the pressure in the sewer pipes and forced sewer gasses into the homes near the landfill. The Leachate Reintroduction Plan technical memorandum concluded that the sewer can accommodate a leachate flow rate of 90 gpm, without a significant rise in pressure.
The memorandum provides no explanation of why an 85 gpm leachate flow produced enough pressure in the sewer system to cause odors in homes odors and why a 90 gpm clean water flow rate produced no pressure reading in the sewer above the established testing limit. Such an explanation is needed to understand the underlying causes of the odor event, and to evaluate and develop adequate monitoring systems and controls to prevent odors entering homes in the future.

<u>Response</u>

Several factors alone or in combination probably explain why pressures in the sewer were acceptable in March at a flow rate of 90 gpm but might have been unacceptable last August/September at a flow rate of 80-85 gpm:

- The sewers were cleaned in the interim. If a physical blockage was present in the sewer system when the odors were noticed, it could have caused abnormal pressures. Removal of the blockage (on its own or by cleaning) would remove the cause of the abnormal pressures.
- An unusual surcharge condition was present in August/September and not in March. An example of an unusual surcharge would be emptying a swimming pool into the sewer or a similar discharge in the neighborhood. An unusual surcharge in August/September would have been in addition to normal sewer flows and the leachate discharge and could have created abnormal pressures. The absence of such a surcharge in March could explain the absence of abnormal pressures.
- Gradual changes in flow rate create less pressure than sudden changes of flow rate. The clean water testing in March involved incremental increases in discharge flow rates (first to 60 gpm, then to 75 gpm, then to 90 gpm), whereas the leachate discharge operations in September were full on (80 gpm) or full off.

Either a temporary sewer obstruction or an unusual surcharge condition would be consistent with odor complaints being noted after decades of discharge of leachate to the sewer without odor complaints. The monitoring and control systems planned (see SCS Responses 2 and 3 below) will provide BFI with the ability to reduce or eliminate leachate discharges in real time should future obstructions or surcharges be observed in the system.

With respect to sudden slugs of leachate, going forward this is no longer the case since the leachate underground storage tank (UST) pump is now equipped with a VFD to introduce leachate into the sewer at a gradual rate.

BFI has performed extensive testing to identify leachate flow rates that negatively impact the sewer; however, each test shows that the sewer system is working as designed and is not stressed, even at the maximum discharge rates that BFI is proposing. Test results show that if a home has a functional P-trap and their plumbing system is not otherwise damaged, then sewer gases should not enter the home.

BFI has recommended residents have their traps inspected and offered a plumber to perform the inspection. To date, only one residence accepted this offer. The plumber found a leak within the venting system in the attic space of the home. We continue to recommend that homeowners who have previously observed sewer gases should have their home sewer system's traps and vents inspected by a licenses plumber.

Schematic diagrams of the landfill leachate collection system along with a description of how it is operated needs to be included. The description should show the configuration of pumps and controls at the time of the initial odor issues and then the current configuration and the added controls. Details such as where the new variable-speed pump(s), flow monitoring equipment, and gravity feed sections of pipe are located should be included. The remote monitoring and control system capabilities should explain when and how alarms will be transmitted, who will receive such alarms and what will be done to respond. If there are automatic controls, they should also be explained.

Response

Landfill Leachate Collection System

Monroe Township's landfill leachate collection system operates by both a gravity-fed system and pump station operations. Perforated piping is installed along the interior perimeter of the cutoff (slurry) wall that surrounds the Landfill. As discussed below, this perforated piping collects and deposits leachate in one of three pump stations, and ultimately all leachate passes through the front pump station, also known as the AB Sump.

Refer to the attached Figure 1 for a site plan detailing the gravity and force main systems, as well as locations of the various manholes, pump stations, and holding tanks. Also attached are two process and instrumentation diagrams (PID) for the existing and proposed system configurations referenced in the discussion below.

Landfill Leachate Collection System (PS-A)

The perforated collection piping from manholes (MH-) 4, 5, 6, and 7 directs leachate into Pump Station A (PS A). Inside PS A, two pumps operate on a lead-lag system, guided by float level sensors, which discharge into a force main that exits into MH-3. MH-3 then gravity feeds into MH-2, then MH-1, and finally into the AB Sump. Perforated piping ends at MH-1, with solid piping to AB Sump.

Landfill Leachate Collection System (PS-B)

Leachate in perforated piping from MH-7, 8, 9, 10, 11, and 12 is directed into Pump Station B (PS B). Inside PS B, two pumps operate on a lead-lag system, guided by float level sensors, which discharge into a force main into MH-12A. MH-12A then gravity feeds into MH-13, where the perforated piping ends. From MH-13, in solid piping, leachate gravity feeds into the AB Sump.

Landfill Leachate Collection System (AB Sump)

Leachate enters the AB Sump via gravity from Manholes MH-1, 2, 3, 12, 12A, and 13. Once leachate is collected in AB Sump, two pumps operate on a lead-lag system, guided by float level sensors, to discharge leachate into the Underground Storage Tank (UST). From the UST, leachate is typically discharged through piping that directs liquids through the flow meter and then out to the sewer. A single pump operates in the UST with its operations guided by a float level sensor. A backup pump for the UST is maintained on site in the event of repairs or malfunction to the primary pump.

Landfill Leachate Discharge System (UST)

The underground storage tank (UST) is also fitted with an overflow line that feeds back to the AB Sump in the event that the UST receives to much liquid. There is also a manual valve that allows the liquid to bypass the UST, however this line is only used in emergency situations.

SCADA Controls

PS A, PS B, AB Sump, and the UST are all interconnected with an onsite control system, also known as a SCADA system (Supervisory Control and Data Acquisition). The SCADA systems allows the liquids levels, pump operation, and historic trends to be viewed both on site and remotely. This system also monitors for methane in the UST and pH of the discharging leachate in the meter pit.

Level Sensors

Within PS A, PS B, and AB Sump, the float level sensors indicate low level, lead pump on, lag pump on, pump off, and high level. Under normal operation, the UST level sensor indicates low level, pump on, pump off, and high level. High level alarms send out an electronic notice to a list of technicians who can address the alarms.

Programmed Operations

Typical pump stations operations have the pump station's controls in an automatic mode where the floats and the SCADA system control the pump operations. When a predetermined elevated level is reached in the UST, the SCADA controls remotely turn off the automatic pumps in PS A and PS B. Once the UST is lowered below that threshold, the PS A and PS B pumps are reactivated to continue pumping. The AB Sump is always in automatic mode to accommodate incoming flows. The perforated collection piping from MH-1, 2, 3, 13, 12, and 12A continuously gravity feed leachate into the AB Sump even when no pumps are in operation in PS A or PS B. Having the AB Sump always in automatic allows the gravity flow to be controlled and directed into the UST.

Manual Operations - Frac Tank Filling

When the temporary frac tanks are in use, the UST pump is manually operated to discharge leachate into one of two frac tanks. The selection of which tank is filling is manually controlled by a technician via a series of valves. Inside of these two frac tanks are high level alarms with a combination of visible warning light and audible sound when a tank has reached a high level. The alarms conservatively allow time for the technician to disable the pump, close appropriate valves, and visually assess the frac tank's liquid level.

New Safety Controls

Newly implemented controls at the landfill include high level alarms in manholes, a variable frequency drive (VFD) for UST pump control, and improved alarms for the tank filling operation. As elaborated below, proposed controls include automatic pump operation, automatic valve operation, increased tank monitoring, and technician notification.

New Safety Controls - UST Pump Controls

The automatic pump controls will direct flows out of the UST. Once a predetermined level has been reached in the UST, a VFD will activate the pump to discharge liquids to the sewer. Flow through the in-line flow meter will relay a signal back to the VFD to either increase or decrease speed to match a preset flow rate. For instance, if 45 gallon per minute (gpm) is the setpoint and the flow meter is registering 50 gpm, the VFD will decrease the motor speed of the pump until the desired rate is reached.

New Safety Controls - UST Total Discharge Controls

Starting in 2020, the Landfill's maximum allowable daily discharge into the MTUD sewer system was 70,000 gallons (as stipulated in the MCUA wastewater discharge permit). If the daily leachate generation is approaching or exceeds the daily discharge limit, the automatic pumping controls will slow down and then stop the pumps. The automatic valving controls will switch the discharge direction to have flows directed into onsite storage. After the appropriate valves have been opened or closed, flow will resume to fill the onsite tanks. At the start of a new day the lines will begin discharging to the sewer system again.

New Safety Controls - Onsite Storage

The additional onsite storage will consist of five 21,000-gallon frac tanks. These tanks will be interconnected for liquid level equalization. Level sensors and high level alarms will be placed inside the tanks. The sensors and alarms will work with the pumping controls to halt additional pumping if the liquid level reaches a high level. The high level alarm will send out a notice to a list of technicians who can address the liquid levels. The onsite storage will have the ability to discharge liquid (1) back into the leachate collection system near the Controls Building and out to the sewer, or (2) to have a hauling company connect to the tanks with tankers to haul leachate offsite.

Real-time pressure, flow and VOC monitoring should be installed prior to the introduction of leachate. Lack of real-time monitoring and assessment does not provide an opportunity to adjust leachate flow rate in the event the flows and or pressures or VOC levels in air are approaching, or have exceeded, established tolerance limits during leachate discharge. Data collection and analysis after the discharge does not provide information when it is needed to achieve the objective of preventing another odor intrusion incident. Real time monitoring of flow, pressure and VOC levels is recommended to allow the operator to assess flow and pressure conditions and VOC levels in air in the sewer system to enable the operator to proactively adjust feed rate before exceeding the flow and pressure limits deemed acceptable to all parties.

Response

> BFI will install pressure, and flow monitoring devices with the ability to relay data through cellular or other means to provide notifications when preset conditions are met. Once these conditions are observed the discharges to the sewer system can be halted until the recorded data can be reviewed and assessed to determine if a malfunction caused the incident or if there was an abnormal background flow condition. SCS recommends manually monitoring around the manhole lids to determine if VOC are being discharged from the sewer system during the initial leachate introduction event. Manual VOC monitoring provides real time information that can be relayed from the monitoring technician to personnel controlling the pumping rate.

An analysis and proposal of leachate storage capacity should be provided.

<u>Response</u>

Storage capacity at the Landfill will be provided based on operation of the UST pump discharging up to 45 GPM to the sewer system. BFI is currently preparing an area to store five (5) 21,000-gallon storage vessels (frac tanks), all within secondary containment to protect surface water in the event of leak or spill. These vessels will provide approximately 105,000 gallons of additional storage capacity. When needed a pump will be programmed to direct liquids to these tanks instead of (or in addition to) discharging to the sewer depending on the scenario.

An analysis of the week of 3/15/21 is displayed in the following table. If the Landfill is able to discharge up to 45 GPM that would permit the disposal of up to 64,800 gallons per day to the sewer system. As noted in Response 2, the maximum permitted leachate discharge rate to the sewer is 70,000 gpd.

Date	Day	Flow	Discharge	Difference	Cumulative
3/15/2021	Monday	90,000	64,800	25,200	25,200
3/16/2021	Tuesday	84,000	64,800	19,200	44,400
3/17/2021	Wednesday	78,000	64,800	13,200	57,600
3/18/2021	Thursday	80,000	64,800	15,200	72,800
3/19/2021	Friday	96,000	64,800	31,200	**104,000**
3/20/2021	Saturday	42,000	64,800	-22,800	81,200
3/21/2021	Sunday	12,000	64,800	-52,800	28,400

In this scenario, a total of 104,000 gal would be required to be stored as this quantity would be in excess of the total amount which could be discharged to the sewer system. This excess quantity could be held over to the following week or hauled off.

The March 15, 2021 week discussed in the Table above is a conservative assumption. In part this is because the Landfill was not hauling liquids for offsite treatment during the weekend prior; therefore, excess liquids were stored over the weekend. Moreover, the data in this table represent liquid quantities hauled as opposed to leachate generated. Given the conservative storage requirement noted above, the proposed tank capacity of 105,000 gallons (five tanks at 21,000-gallons) is sufficient. A margin of safety is provided by the following features:

- The UST capacity of 20,000-gallons
- The capacity of Pump Stations A and B to store liquids
- Removal of liquids via hauling operations for which both trucking and disposal contracts are already in place.

APPENDIX D

Response to MTUD Comments

COMMENTS FROM JOE STROIN'S 4/8/21 EMAIL:

Status of VFD installation and associated operation protocols of the VFD for leachate re-introduction as the VFD was not utilized during clean water testing.

Response

> Equipment for VFD installation and calibration is on-site and will be completed prior to introduction of leachate to the sanitary sewer. Additional containment and improvements to the collection and discharge system are being completed prior to completing the VFD improvements.

Potential effect of vapor pressure emanating from the VOC compounds in the leachate (especially those compounds that exceeded the AIHA odor threshold values as identified during vapor testing by both Jacobs/Township and SCS/Republic), versus water which has a low vapor pressure. This effect could be magnified further with warmer temperatures.

Response

> Pressure monitoring of the sanitary sewer during background conditions and clean water testing was completed to establish thresholds for leachate reintroduction which should not impact standard backflow prevention from residential homes. Monitoring equipment will be utilized during reintroduction of leachate to provide warnings of pressure concerns, including any vapor pressure from VOC evaporation from leachate, and adjust the discharge as needed.

The need for permanent instrumentation in the sewer collection system to monitor real time pressure and flow and then correlate that data with operational protocols of the VFD for both flow and shutdown should the pressure exceed the established minimum threshold of 75% of the expected capacity of home sanitary sewer gas protection system (i.e. 1.5 inches of water column).

Response

> Monitoring equipment will be utilized during reintroduction of leachate to provide warnings of pressure concerns, including any vapor pressure from VOC evaporation from leachate, and adjust the discharge as needed.

Why are past operational protocols being changed from the intermittent 15 min. on/15 min. off lead/lag operation of the A/B sump which ultimately controlled the level of the UST and associated operation of the constant speed pump that discharged leachate (at 80- to 87 gpm) into the MTUD sewer system to a longer duration steady flow albeit at a targeted lower flow rate of 45 gpm. MTUD SCADA analysis showed that long duration pumping into the sewer system had a direct correlation to the odor events in August and September.

Response

The past operational protocol was not operated on a timer (15 min on/15 min off). The lead/lag system was operated by float sensors reading leachate levels within the pump stations and sump at the landfill activating the pumps as necessary to manage liquid conveyance to the underground storage tank (UST). The lead/lag operation of the A/B Sump, Pump Stations A and B (PSA, PSB) and the discharge through the UST will still be utilized in the revised leachate discharge operation.

The analysis completed on induced pressures within the sanitary sewer from leachate discharge indicated the long duration at higher flow rates may have been a cause of odor detections in August and September. The analysis also indicated sustained flow at lower discharge rates would have a significantly reduced potential for pressure related challenges.

Pressure and flow monitoring equipment will be utilized during leachate introduction to provide warning of any concerns during operation.

VFD PITFALLS RAISED IN JOE STROIN'S 2/11/21 EMAIL

Response

On/off valves exist within the discharge controls at the site.

Shielded cabling is typically utilized for instrumentation communication cables on-site.

The VFD being installed is a new unit, not a used system.

The pump curves were assessed in selecting the appropriate VFD giving consideration to the pump head, piping setup, and on-site controls.

ATTACHMENT A

Sewer Evaluation

SEWER SIZE EVALUATION

This sewer size evaluation disregards sewer air dynamics to determine the theoretical limiting size of the sewer solely based on liquid flow mechanics. The clean water injection plan in Attachment B will attempt to identify if there are any localized sewer headspace air restrictions within the sewer system that may cause air pressurization during leachate pumping events.

Table 1 shows the calculated capacity for the sanitary sewer system pipes filled to half their depth along Lani, Michelle and Lori Streets using the Manning Equation:

$$Q = (1.49/n)(A)(R^{2/3})(S^{1/2})$$

Where Q is the discharge, n is the Manning roughness coefficient, A is the cross-section area, R is the hydraulic radius, and S is the pipe slope.

As shown in Table 1 the capacity of half-full sewer pipes in the system range from a low of 207 gallons per minute (gpm) to a high of 625 gpm. The section with the lowest flow capacity may limit the flow through the sewer system unless another reach of the sewer is determined to be the limiting factor due to air restrictions within the sewer. Upon first review it appears that the sewer reach between MH-3 and MH-4 on Lani or MH-6 and MH-7 on Michelle Street have the most limited ability to transmit sanitary sewer flows.

FLOW BASED RESTRICTIONS

This section disregards sewer air dynamics to determine the theoretical limiting size of the sewer solely based on liquid flow mechanics. To calculate how much the Landfill can discharge without exceeding the capacity of the sewer system, we must first calculate the expected residential loading of the sewer system. New Jersey Administrative Code (NJAC), Title 7 - Environmental Protection, Chapter 14A, Subchapter 23.3, states that the criteria for estimating the volume of sanitary sewage from single residential occupancy activities shall be based on assuming 300 gallons per day (gpd) for a 3 bedroom unit or larger.

Residential listings along the contributing sewers include a number of 4 and 5 bedroom homes; therefore, to be conservative, we assumed all homes have at least 3 bedrooms and thus contribute approximately 300 gpd for design purposes.

NJAC 7:14A-23.6 (Sanitary sewer design) requires gravity sewers to be designed to carry at least twice the average projected flow when flowing half full. This requirement recognizes that peak sewer flows occur when a neighborhood wakes up and takes a shower to start the day, or washes dinner dishes and takes baths at the end of the day. A number of studies have been

performed to map this diurnal pattern. Table 2 is based on one such study;1 it shows the diurnal flow pattern in half hour intervals to allocate the percentage of daily flow that is expected to occur during each half hour period. This Table shows that the highest percent of daily discharge from residential homes is expected in the 8:00 AM to 8:30 AM interval when 4.6% of the total daily flow is discharged. For a single home this works out to an average discharge rate of 0.5 gpm for this

[1] Gurung, T.R. Stewart, R.A. Sharma, A.K. Beal, C.D. (2014) Smart meters for enhanced water supply network modelling and infrastructure planning, Resources, Conservation and Recycling, 90, 34-50. http://dx.doi.org/10.1016/j.resconrec.2014.06.005.

half an hour period.

As discussed above, the sewer pipe between MH-6 and MH-7 on Michelle Street is one of the most limiting sections. Thirty-six homes contribute to this section and thus peak diurnal residential loading is expected to be 36 X 0.5 gpm = 18 gpm. In other words, even if this section of sewer pipe contained 18 gpm (4.6% of the total daily flow from 36 houses), it still would have about 200 gpm of available capacity. Similiarly, MH-3 and MH-4 has the same result with about 200 gpm of available capacity. This is more than double and in some cases quadruple the rate at which the landfill currently intends to inject leachate.

SEWER EVALUATION

After reviewing the video and profile information provided by the Township the following was inferred. Based upon residue observed on the upper portion of the sewer pipe along Michelle Street during the camera inspection, it appears that flows in the sewer pipe might have exceeded the design flow capacity of the sewer pipe. The cause of the residue observed on the ceiling is unknown; it may be due to the pipe being temporarily or partially blocked or to abnormally high flows. Either cause would increase the likelihood of odors being emitted from a sewer system.

The evaluation of the sewer system did not conclusively reveal why some residents experienced odors in their homes. However, the most likely scenario involves flow conditions that exceeded the existing operating range of the sewer system. As discussed above, this scenario could have been caused either by excessive sewer flow and/or a temporary blockage within the sewer system and is partially supported by the observance of residue on the ceiling of the sewer pipe along Michelle Street. However, it is also possible that elevated flows for extended duration within the sewer system made localized air pressure points within the sewer system that then pushed sewer gases into residences. This second theory will be tested in the proposed clean water injection plan included in Attachment B.

ATTACHMENT B

Background Flow Evaluation and Clean Water Injection Testing

This attachment addresses testing requirements to establish the safe re-introduction of leachate from the Monroe Township Landfill into the Township's sewer system. This document incorporates comments and suggestions from the Technical Meeting held on December 14, 2020, January 19, 2021 EPA Comments, January 20, 2021 Task 2 Memo by Jacobs Engineering, Inc., and the January 19, 2021 Task 3 Memo by Jacobs Engineering, Inc.

1 BACKGROUND

Leachate flow rates and durations appear to be key contributing factors to pressures being induced within the sewer system that could result in odors infiltrating certain homes along the sewer line. These induced pressures are suspected of exceeding the normal design limits of a traditional home P-trap, which is one component of a home sewer gas protection system. The P-trap holds water in the inverted "P" of the trap which forms a water seal to prevent gases in the sewer from entering the home. By building code, building sewers must be vented through the roof to avoid pressure buildup within the sewer which would cause sewer gases to push through the trap. Not knowing the conditions of the home vent systems, we assume the home is dependent on the P-trap to prevent pressurized sewer gases from entering the home. For this plan, it is assumed that each drain in a residential home is protected with a P-trap that has at least 2 inches of trap seal depth as shown in Figure 3.

This clean water injection test plan intends to inject clean water into the sewer system at various flow rates that will mix with residential sewage flows. The total sewer flow will be monitored with flow meters at strategic locations and pressure transducers will be installed in each manhole along the route specified below. The pressure transducers will document and record positive and negative pressures within each manhole. The pressure data will be compared to the flow data to estimate the flow levels at which pressurization events occur. As a conservative measure, testing will create conditions not exceeding 75% of the capacity of a traditional home sewer gas protection system to inhibit sewer gases from entering residences during testing.

2 AREA OF INVESTIGATION

This investigation will mimic leachate flow from the Landfill's Underground Storage Tank (UST) through the sanitary sewer system as it travels from manhole one (MH-1) through MH-7, as shown on Figure 1. Beyond MH-7 sanitary sewer liquids drain to MH-9 and beyond. Figure 1 was created to show the general path of alignment for the landfill discharge piping and sanitary sewer systems being investigated as part of this work.

The landfill discharges into a termination manhole (MH-1), which is the first manhole of this sewer segment. The only liquids that pass through this manhole are liquids coming from the landfill. The overall sewer segment under investigation primarily receives flow from homes along Lani Street, Guinevere Road, Launcelot Lane, and Michelle Street; these flows then mix with flows along Lori Street.

The Township camera inspection of the sewer pipes along the route, documented that no sewers were blocked off with debris or sewer liquids during normal background operating conditions for the time of the day of the inspection for each segment. It is also currently understood that odors from the sewer system have not been detected/reported by residents since the time the landfill discontinued discharging liquids into the sewer system. Therefore, the background pressures and flows are believed to be operating at relatively low pressure gradients and are not exceeding residents' home sanitary sewer gas protection systems.

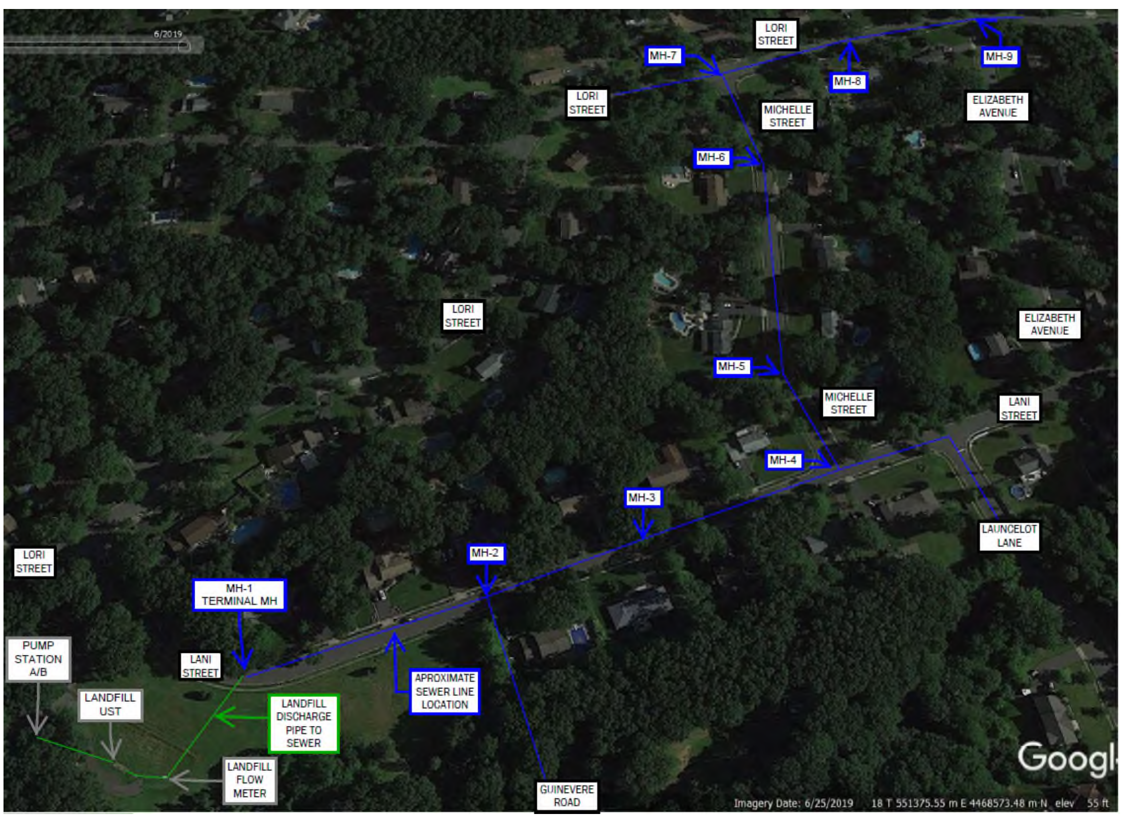


Figure 1. Limits of Sewer Investigation (Image taken from Google Earth)

3 HOME SEWER GAS PROTECTION SYSTEMS

Residential plumbing includes multiple fixtures (sinks, toilets, showers, etc.) all combining to a single sewer discharge line below grade and sloped toward the sewer main. This allows waste water to drain away from the home and toward the sewer main, but it also allow sewer vapors to migrate back up this sewer pipe toward the home. Home sanitary systems have components in place to prevent sewer gases from entering the living area of the home. As shown in Figure 2, each fixture within the home should be protected by a trap, which uses the water discharged from that fixture as a seal to prevent sewer gases from entering the home. The home's sanitary sewer is also connected to a vent stack penetrating the roof that allows atmospheric air to be drawn in or pushed out as needed to minimize pressure/vacuum buildups within the home's sanitary lines and keep the system operating as designed.

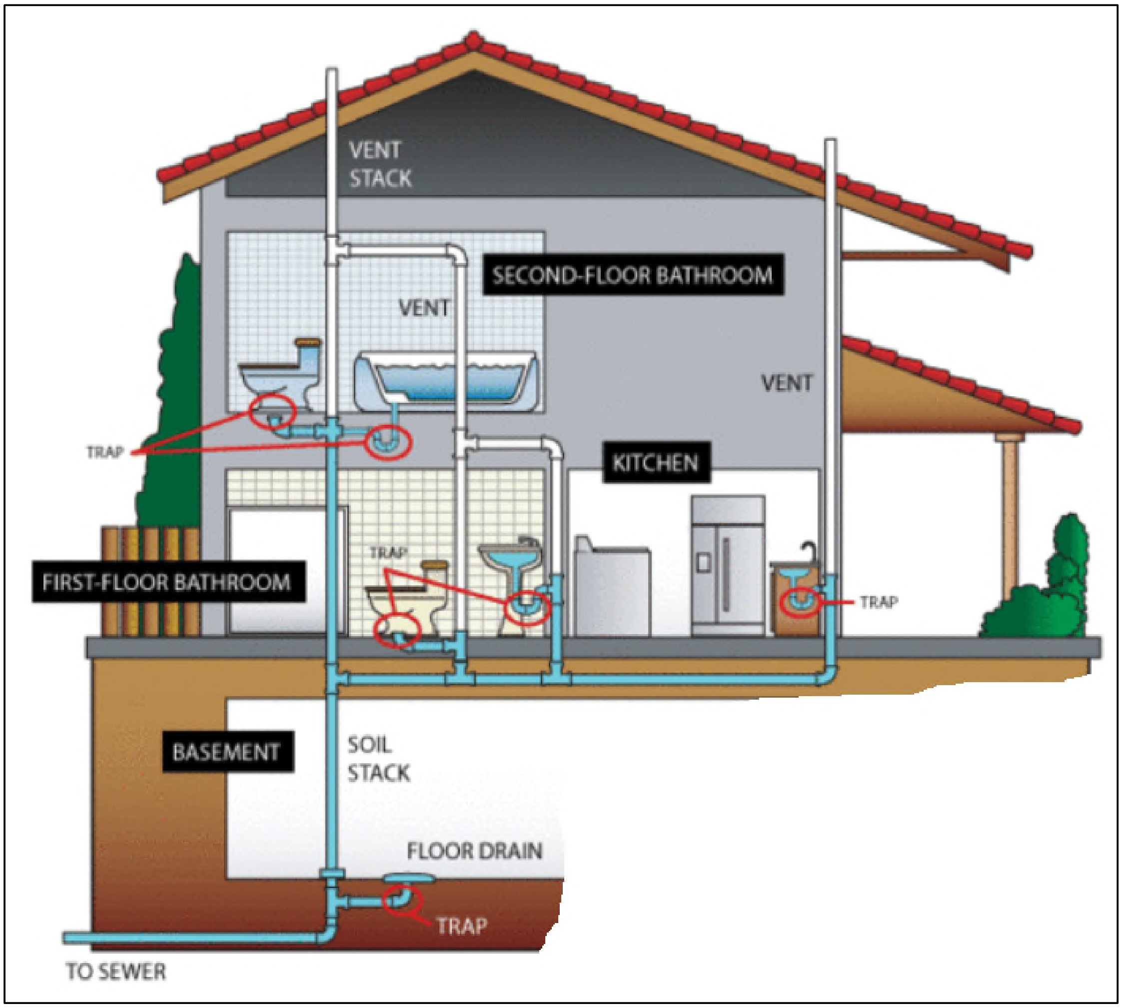


Figure 2. Home Sewer System Gas Protection (Image from Northeast Ohio Regional Sewer District), https://www.neorsd.org/work-made-to-odor-smell-may-annoy-bu/

A more detailed view of a traditional P-trap that might be found in a home is shown in Figure 3. A home P-trap is expected to be able to handle at least 2 inches of water column (w-c) pressure before sewer gases are able to push through the trap into the home. Traps similar to this will likely be found on sinks, tubs, floor drains, and laundry washing machines. Toilets have traps integrated into their design and a good connection between the toilet and the sanitary pipe needs to be completed to prevent odors from entering the home. Because these traps rely on the water discharged from the fixture, some traps will be subject to failure due to evaporation of the liquids in the trap. This is often seen on floor drains where there is not a regular addition of new water to the trap. This may also occur on any other trap within the home where the water might evaporate quicker than new water is added to the trap. A licensed plumber might be able to recommend a waterless trap or other retrofit if this occurs in a home.

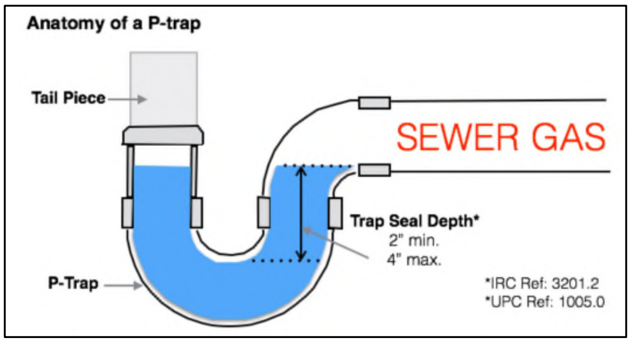


Figure 3. Home Sanitary Trap (https://www.hammerpedia.com/how-to-plumb-a-bathroom/)

Standards for plumbing and venting have changed over the years and traps other than those described above might be in use. For example, some older homes have a whole house trap which may have a trap seal that offers greater than 2 in of w-c of pressurization protection. These house traps also require proper venting and may need to be vented on both sides of the trap to allow the system to operate as designed. Therefore, homes with a house trap may have a vent located in their yard as well as penetrating through their roof. If either of these vents become clogged or blocked off the home's sewer system may not be operating at its designed capacity. If a home owner has questions about their home sewer system they should contact a licensed Plumber who will be able to asses a home's sewer system and inform the owner if the system is currently operating as designed.

For this investigation, it was assumed that the sanitary sewer system for each home is capable of preventing sewer gas infiltration into the home from the sewer system from pressurizations up to 2 in-w.c. at each trap; 75% of that assumed minimum capacity was used as a design threshold. These design assumptions result in a conservative estimate of the ability to introduce liquids into the sewer system without causing sewer gas to be released into the homes connected to the sewer system.

The P-trap shown in Figure 3 that has a 2-inch trap seal depth, when working as designed would actually protect the home from sewer gas pressurization events of up to 4 inches of w-c. This designed capacity has been conservatively reduced to 2 inches of w-c in the anticipation that the sewer system may generate vacuum events as well. The P-trap show in Figure 3 if exposed to 2 inches of vacuum (negative pressure of 2 inches) would result in 2 inches of water draining out of the trap and down the sewer. The trap's capacity to prevent pressurized sewer gases from entering the home would then be reduced to 2 inches. The trap would be restored to full capacity once the trap is refilled the next time water runs down the drain. It is recommended residents fill all their traps regularly to keep them operating at full capacity.

4 UNDERSTANDING THE SANIARY SEWER SYSTEM

The sanitary sewer system can be described simply as a pipe that drains liquids and some solids from one point to another. The act of draining liquids causes air to be displaced within the sewer through a combination of water drag and the fact that water is physically displacing air within the pipe.

Air within the sewer generally will move in the same direction as water due to the water drag force. If the volume of air in a subsequent section of sewer is moving at a slower rate than the previous section, then the excess air will try to escape at the first available opportunity (such as a manhole or perhaps a lateral vent.) This also applies in extreme cases when the entire pipe might become blocked off with liquids forcing the air to escape the sewer system. This scenario is more likely to occur when pipe segments within the sewer system transition from a steeper segment to a flatter section, causing water levels in the pipe to rise and reducing the ability of the subsequent sewer pipe to transmit air. Air movement is further hindered because water in the flatter section flows at a slower speed, thus dragging the air at a slower speed. In this scenario the sewer system is likely to generate a positive pressurization event. The above scenario can and does occur in the reverse as well and will cause the opposite effect with atmospheric air being drawn into the sewer system, resulting in a depressurization event (negative pressure) within the sewer system. As atmospheric air is drawn into or pushed out of the sewer system the pressurization/depressurization event will dissipate if flows are reduced. If flows are increased and exceed the ability for the sewer system to breath to the atmosphere the magnitude of the pressurization/depressurization will continue to increase.

Sewers may transmit liquids through drop structures. Plunge drop structures allow liquids to free fall to a lower elevation which leads to increased velocities and may cause air to be pulled into the sewer system through the manhole. If flows increase too much, the drop structure manhole may quickly transition from drawing air into the manhole to pushing air out of the manhole due to the downstream pipe being fully blocked off by the flow of the liquids. Replacing plunge drop structures with vortex structures would allow the flow to spiral down the elevation decline and minimize the disruption to the liquid flow. Vortex structures also draw air into the sewer with the liquid, reducing pressurization of the manhole.

Air exchange between the sewer and ambient atmosphere also occurs. Sewers are generally warmer than atmospheric air during the cooler parts of the year and the denser cooler air will push the less-dense warmer air out of the sewer. This can result in driving odors out of the sewer system.

5 MONITORING OF THE SEWER SYSTEM

This plan proposes to monitor the sanitary sewer system during background monitoring, clean water injection, and during the initial leachate reintroduction period. Equipment includes flow meters, pressure transducers and photo-ionization detectors to document liquid flows, sewer gas pressures, and the presence of volatile gases escaping the sewer. Each meter is discussed in additional detail below.

FLOW METER

Three temporary flow meters will be installed and monitored along the sewer path that leachate normally flows. During the initial background phase, no liquids will be discharged from the landfill. Thus, there will be no flow through the Landfill's existing flow meter. The three temporary flow meters will be installed along the sewer route as follows:

1. Two temporary flow meters will be installed in MH-4:

   a. one to monitor flows coming from the Landfill, Guinevere Road, and the houses located west of this manhole along Lani Street, and

   b. the second to monitor flows that come from east of MH-4 and from Launcelot Lane.

2. The third temporary flow meter will be installed at MH-7 and will monitor the flows being discharged from Michelle Street to Lori Street.

These meters will provide information on the community usage during background conditions; they will be used to generate a background diurnal curve for flow through MH-7.

The Teledynce Isco, Inc. Isco 2150 Area Velocity Flow Module will be scheduled for installation by a specialty subcontractor and will be coordinated with the Township to allow for oversight of the installation process. The installation and operation manual for this equipment can be found here: https://www.teledyneisco.com/en-us/waterandwastewater/Flow%20Meter%20Documents/Manuals/2150%20Flow%20Module%20User%20Manual.pdf

The unit will be programmed to record the level, velocity and flow rate in the sewer at least every five minutes. During periods when flows within the sewer system exceed two inches in depth, the flow meter will automatically start recording these parameters every 15 seconds. After the flow dissipates to under two inches, recordings will resume at five minute intervals. Total flow and input voltage will be recorded once a day.

PRESSURE TRANSDUCERS

A total of seven pressure transducers will be temporarily placed in each manhole along the route from MH-1 to MH-7.

Pressure readings within each manhole will document the pressures being observed in the sewers system and will provide indications if flow patterns within the sewer system are causing pressurization/depressurization events that are exceeding permissible limits or have otherwise changed from the background phase flow and pressure dynamics during later testing.

The Acrulog differential pressure logger will be the pressure transducer utilized. The pressure logger will be able to monitor at least within the range of -2 to +2 inches of w-c. Each pressure transducer will be hung in a manhole suspended above expected flow elevations. The unit will be programmed to record data at one second intervals.

PHOTO-IONIZATION DETECTOR

A Photo Ionization Detector (PID) will be handheld and utilized to determine the concentration of VOC's in the manhole prior to personnel entering the manhole. Concentrations of VOCs will be recorded.

PIDs will also be utilized to periodically inspect around the manhole lids to test for evidence of pressurized sewer gases and VOCs escaping the sanitary sewer system during the initial background phase, clean water phase and the initial day of leachate reintroduction. Any concentrations of VOCs being detected will be recorded. Special attention will be paid to penetrations in the manhole, such as any pick holes or other locations which are suspected of being breathing points for the sewer system.

During background testing an operator will walk a path adjacent to the sewer system and will stop at each manhole and use the PID to check for VOC concentrations at each manhole lid. The operator will document any VOC concentrations detected.

During clean water testing an operator will walk a path adjacent to the sewer system and will stop at each manhole and use the PID to check for VOC's concentrations at each manhole lid. This will continue for the duration of the testing period. The operator will document any VOC concentrations detected.

During the initial day of leachate introductory an operator will utilize a PID to check each manhole at least once during a leachate pumping period. The operator will document any VOC concentrations detected.

These VOC readings will be compared to background and clean water flow conditions. An increased level of VOC emissions would be made evident during pressurization of the sewer system. However, we expect the VOCs to dissipate when vented to the atmosphere through the manhole lid and then be further dispersed by natural wind currents and vehicle induced air currents. Therefore, it is not expected that the public would be exposed to the concentrated levels detected with the PID. PID readings will be recorded and elevated concentrations above background monitoring will be compared to pressure transducer readings near that location.

6 PROPOSED INITIAL "BACKGROUND" MONITORING

This plan proposes to monitor the sanitary sewer system using flow meters, pressure transducers and photo-ionization detectors to document liquid flows, sewer gas pressures, and the presence of volatile gases escaping the sewer on a typical day. This is also referred to as background monitoring.

The initial phase of background monitoring will assess the current day-to-day activities of the community's sanitary sewer usage. This initial phase will employ a number of data collection devices to monitor sanitary flows for at least 24 hours. At the end of the data collection period, the sanitary sewer lids will be opened to allow connection to the data ports of the devices to download the collected data.

REVIEW OF DATA

Once the data are recorded and collected for the background monitoring period, these data points will be analyzed to determine a baseline of sewer operations. Abnormalities detected in the pressure data will be correlated to flows. If pressures are significant enough, the clean water injection plan described below may be modified to adjust to account for these conditions. The proposed clean water injection flow rate will also be adjusted based on documented residential background flow usage.

7 CLEAN WATER INJECTION TESTING

The intent of injecting clean water into the sanitary sewer system is to find the points at which the sanitary sewer is stressed, causing excessive sewer air pressurization/depressurization. As discussed previously, localized parts of the sewer system may become stressed under certain conditions. The stress point at which this testing will be stopped will be at 75% of the minimum expected capacity of the home sanitary sewer gas protection system (i.e., 1.5 inches of water column).

During the clean water injection test, a clean water source will be connected to the 2-inch discharge line at an existing junction point located in the UST tank which will then flow through the Landfill's flow meter as shown on Figure 1 prior to discharging to the sanitary sewer system. In addition to monitoring the flow through the Landfill's flow meters, the clean water injection test will employ the same monitoring devices employed in the initial background testing (i.e., three temporary flow meters, pressure transducers and PID).

Water for the clean test will either be supplied by a nearby fire hydrant with a backflow preventer, flow meter, and control valve or a water truck with a flow meter and control valve. The source will then be connected to the UST 2-inch discharge line. The control valve will then be adjusted until the desired rate is reached. Once the desired flow is reached the test may commence. At the end of each clean water injection flow rate, the clean water injection into the sewer will be stopped. This stoppage will allow the sewer to return to normal background conditions and provide time for the pressure transducer data to be collected and confirm that pressurization/depressurization events are not being observed. If rates begin to approach the permissible pressure rate, the subsequent proposed flow rates can be reduced to reduce the chance that permissible pressures are exceeded.

CLEAN WATER TEST RATES[1]

1. 45 gpm for 60 minutes
2. 60 gpm for 60 minutes
3. 75 gpm for 60 minutes
4. 90 gpm for 60 minutes

Each of the initial clean water tests will be held at a duration of at least 60 minutes which is well beyond the time it should take for water to travel from the UST to MH-7. This amount of time should allow for the sewer system to become stabilized barring abnormal flow disruptions.

Prior to each subsequent test, transducer data will be extracted and peak, minimum, and average pressures will be recorded. The expected background flow patterns for the day shall also be considered so that the flow rate between tests will not be excessively increased. The pressure data from each test will be compared to the previous set of data collected at lower flow rates. If the relative difference between the latest test data and the previous data does not suggest that the next higher flow rate will exceed the defined maximum stress point, then the next test will proceed.

Test data gathered during the clean water rate testing will be downloaded for analysis and review. Pressure and flow data will be provided to the EPA, NJDEP and Monroe Township. The overall flow in the sewer system for each test will be correlated with the pressures recorded by the transducers.

If a flow rate is determined to be continuously safe (not exceeding maximum allowable air pressure) for a period of over 60 minutes, then a maximum pumping rate will be established based on the diurnal curve for this sewer segment that will not exceed the total sewer safe flow rate during the clean water injection test. Permission will be requested to reintroduce leachate at the total sewer capacity rate established during the test from the EPA, NJDEP, and Monroe Township. No limits on continuous pumping time will need to be set if the system can safely pump for a 60 minute interval. The initial leachate reintroduction will be performed during daylight hours, if possible, to facilitate observation of the event.

If a differential pressure is observed in the field during the first day of testing that causes concern then testing will be performed to determine if a shorter duration with a defined interval and maximum flow rate for the sewer can be established. This would be accomplished in the field by making modifications to the duration and rate of the pumping. The pumping duration would be reduced to a time period shorter than the observed elevated pressures during the previous testing event. If shorter durations of water discharge are successfully tested then intervals between pumping events should be tested and established as well. The interval between pumping cycles should not have to be any longer than the time observed for a slug of water from the landfill to pass MH-7. A diurnal curve will be prepared that will limit the rate at which the landfill may pump throughout the day. A limitation on the specified duration and interval between pumping events also will be established. Once these initial reintroduction criterion are approved, the initial leachate

[1] These flow rates may be adjusted for expected diurnal flow rates on the day of testing.

reintroduction will be performed during daylight hours, if possible, to facilitate observation of the event.

If no safe differential pressure can be maintained during the initial day tests, then clean water injection testing will be performed between the hours of 10 PM and 6 AM at the clean water rates proposed above. If safe sewer flow can be established, then pumping hours will be limited to this time interval at the rates that are proven during the clean water rate tests. No limits on continuous pumping time will need to be set if the system can safely pump for a 60-minute interval.

8 RETURNING LEACHATE TO THE SEWER SYSTEM

Once testing is completed with clean water, the results and proposed landfill pumping rate will be provided to the EPA, NJDEP, and Monroe Township. Once a safe rate of leachate discharge has been approved, the Landfill will program its equipment to deliver flow at the prescribed rates. The Landfill will then begin discharging leachate at the approved rates and monitor and record the amount of leachate being discharged from the Landfill into the sanitary sewer system.

During this initial leachate reintroduction the Landfill will continue to monitor the sewer system with the temporary flow meters and pressure transducers and periodically check for gases escaping from the manholes with the PIDs. Monitoring will continue for at least one full cycle for each proposed pumping rate and, if applicable, interval.

Test data gathered will be downloaded for analysis and review. Pressure and flow data will be provided to the EPA, NJDEP and Monroe Township. Once the safe leachate discharge rate has been approved, the temporary monitoring equipment will be removed from the sanitary sewer system. The Landfill will continue to monitor and record the amount of leachate that is being discharged from their facility into the sanitary sewer system.

BFI is committed to continuing working with the EPA, NJDEP, and the Monroe Township to address any future issues that may arise.

ATTACHMENT C

Background Flow Evaluation and Clean Water Testing

February 15, 2021
File No. 13213023.00

MEMORANDUM

TO: Jacob Schmidt

FROM: Bret Clements, Mark Pearson, Chris Woloszyn, Eric Peterson

SUBJECT: MTUD Sewer MH-1 through MH-7 Background Flow & Pressure Analysis 2/5-10/2021

This memo summarizes the observed pressure and flows in the Monroe Township Utility Department's (MTUD) sewer system from Manhole one (MH-1) through MH-7 for the dates 2/5/2021 through 2/10/2021 and times as shown on the attached graphs. Flow meters were installed in MH-4 and MH-7 and pressure transducers were installed in all seven manholes between MH-1 and MH-7. Flow and pressure instruments were specified in previous memos.

The attached Graphs #1-11 are formatted to show up to 120 gpm, 4 inches of sewer depth and +/-2 inches of water column (w-c) so that future graphs can be plotted with the same scaling factors.

1 EXECUTIVE SUMMARY

Per previously approved plans, flow meters and pressure transducers were installed in multiple manholes of the Monroe Township Utility Department's (MTUD) sewer system. The manholes instrumented are labeled MH-1 to MH-7 (as shown on Figure 1). Liquids within the sewer system travel from MH-1 to MH-7, with additional inflow as other laterals and residential connections intercept the sewer system as designed. Flow meters were installed in MH-4 and MH-7 and pressure transducers were installed in all seven manholes between MH-1 and MH-7. Flow and pressure instruments were specified in previous memos. Further descriptions of the manholes and instrumentation follow in this report.

The data presented in this report represents the initial monitoring period from 2/5/2021 through 2/10/21, during a period when no leachate was entering the system from the Monroe Landfill. The data indicate that the sanitary sewer system appeared to be operating normally for the monitoring period, without any significant pressure events observed. Monitoring data of the sewer system identified typical diurnal flow patterns associated with residential systems, and an average flow of 8 gallons per minute through MH-7. The monitoring also documented peak flows of 29 gpm, maximum depth of approximately 1.75 inches. During the entire period, no significant pressure event was observed. These flow observations appear to be well within the design parameters of the system. Detailed discussion of the data follows later in this report.

Based on the successful installation of the monitoring system, and the observation that the system is performing as expected, it is recommended that the clean water injection proceed as previously proposed and as discussed in additional detail in this memo.

2 SEWER EVALUATION

The following section discusses the data and observations by each identified manhole, and is presented in the following order:

- **MH-7:** MH-7 represents the consolidated flow of the area monitored, and contains both a flow meter and a pressure transducer.
- **MH-4:** MH-4 is upstream from MH-7, and monitors the junction of two sewer legs – one which would include leachate flows from the landfill (from Lani Street), and the other represents residential flow from Launcelot street. MH-4 contains two flow meters (one at each inlet) and a pressure transducer.
- **MH-1, MH-2, MH-3, MH-5, & MH-6:** Each manhole represents various monitoring points along the system, and are subject to different contributing flows. Each manhole contains a pressure transducer.

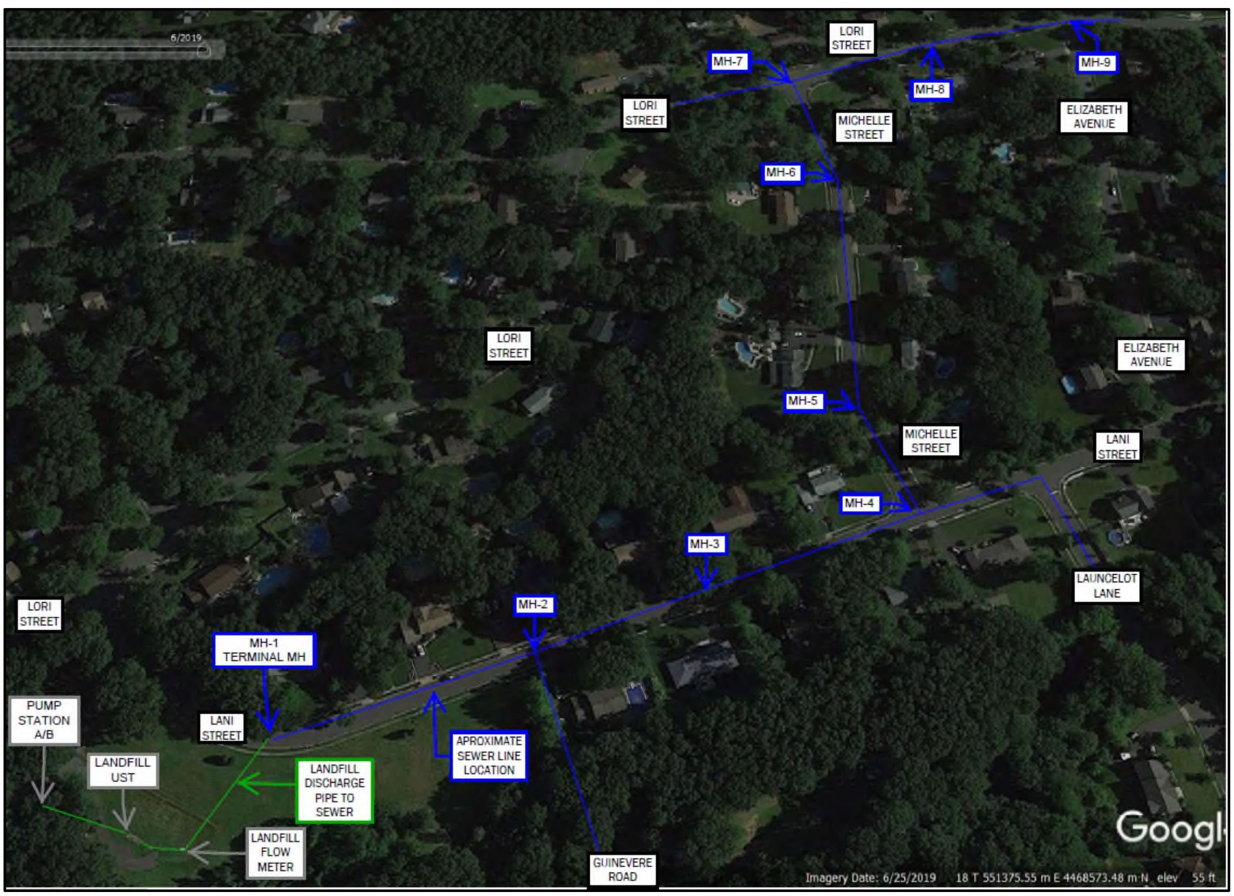


Figure 1. Site & Sewer Layout (Image taken from Google Earth)

MH-7

MH-7 receives flows from the reach between MH-6 and MH-7 as well as all upstream flow passing through MH-6. A flow meter was installed in the sewer main flowing into MH-7 which is documenting flows from Michelle Street, Launcelot Lane, Lani Street, Guinevere Road, and the Landfill.

Flows Observed

Prior to sewer monitoring, average daily flow and peak daily flow were estimated based on regulations and a traditional diurnal pattern resulting in 7 and 17 gpm respectively, passing through MH-7. Actual flow conditions for the period of the afternoon of 2/5/2021 to the afternoon 2/10/2021 ranged between 0 and 26 gpm with an average value of 8 gpm. Flows for MH-7 are shown on attached Graph #1.

Maximum Observed Depth

Note that even at the greatest flow of 26 gpm the sewer depth was documented to be approximately 1.75 inches of the 8-inch diameter sewer pipe, indicating that there is sufficient room for the sewer system to safely transmit at least up to 26 gpm.

Flow Meter Tolerance

The flow meter temporarily documented negative flow around 2/5/21 at 22:00 and 2/8/21 at 9:50. During these periods, the velocity within the sewer was documented as a negative velocity in feet per second (fps). The attached Graph #2 show the negative flows, which were removed from Graph #1. The sewer depth remained fairly constant around 1 inch of depth and did not show a substantial rise during this period which would be a true indicator of substantial back flowing conditions. As previously discussed at the pre-installation meeting, the flow meter calculates flow by measuring velocity and depth and the meter is less accurate at low sewer depths. The meter is known to provide less accurate velocity data as the sewer depth drops below 1 inch, while the water depth will be accurate when water depth exceeds 0.4 inches above the sensor and therefore this falls within reasonable and expected operation for the flow meter. The sewer records also indicate that sewer pipes are sloping from manhole to manhole. For these reasons, negative flow records are being considered as zero flow periods and should be for all future data analysis reviews.

Pressures Observed

The pressure transducers observed positive pressure and negative pressure events within the manhole; however, none of them exceeded 0.5 in w-c which is well below the safe pressure tolerance proposed for the clean water injection testing. Attached Graph #11 show pressures and respective flows recorded during this period.

Overall Evaluation

As expected, no significant pressures were recorded during this period. This was expected as the residential usage is low and is using a small percentage of the total sewer to transmit liquid flows. This leaves the remainder of the sewer that is unused by liquid to transmit air and equalize pressures within the sewer system.

MH-4

MH-4 receives flows from the reach between MH-3 and MH-4 as well as all upstream flow passing through MH-3. Two flow meters were installed in MH-4. One is installed on the West inlet and observes flows from MH-1 through MH-3, Guinevere Road, and will document discharges from the Landfill in the future also. The second is installed in the East inlet and observes flows from Launcelot Street.

Flows Observed

Prior to sewer monitoring, flow was predicted for the west inlet into MH-4 but not for the east inlet to MH-4. However, flows were predicted for MH-5, which is reasonably the same as the combined flow expected in MH-4 (plus or minus a few home connections), and has been used for this comparison. Average daily flow and peak daily flow were estimated based on regulations and a traditional diurnal pattern resulting in 6 and 14 gpm passing through MH-5 respectively. Actual flow records were combined for the east (Attached Graph #4) and west inlets (Attached Graph #3) to determine the total flows experienced by MH-4. Flow conditions for the period of the afternoon of 2/5/2021 to the afternoon of 2/10/2021 ranged between 0 and 29 gpm with an average value of 5 gpm. Graph #8 attached to this document shows the combined flows along with pressures recorded in MH-4.

Flow Meter Tolerance

As noted above this flow meter for MH-4 documented a peak flow of 29 gpm which exceeds the peak flow observed in MH-7 of 25 gpm by about 4 gpm. At first glance this may raise questions about the accuracy of these meters. However, the peak flow at MH-4 calculated to be 29 gpm at 2/9/21 18:20 is observed by the MH-7 flow meter with a flow of about 25 gpm at 2/9/21 18:25. The decrease in peak flow observed at MH-7 is most likely due to the fact that the flow meters are recording data at five minute intervals when the sewer depth is documented to be less than two inches. As noted above, the maximum depth observed for the observation period was less than two inches. The flow could have been slightly obstructed within MH-4 and on its way to MH-7 by other flows and forced to distribute this peak flow over a longer duration at MH-7.

Pressures Observed

The pressure transducers observed positive pressure and negative pressure events within the manhole; however, none of them exceeded 0.5 in w-c which is well below the safe pressure tolerance proposed for the clean water injection testing. Attached Graph #8 show pressures and along with the total flow passing through MH-4.

Overall Evaluation

As expected, no significant pressures were recorded during this period. This was expected as the residential usage is low and is using a small percentage of the total sewer to transmit liquid flows. This leaves the remainder of the sewer that is unused by liquid to transmit air within the sewer system to equalize pressures within the sewer system.

PRESSURE READINGS FROM MANHOLES 1, 2, 3, 5, AND 6

For this evaluation and the associated charts, flows observed within MH-4 and MH-7 were utilized for the upstream contributing Manholes to provide a conservative estimate to background flows entering each manhole and to any conclusions drawn between observed pressures and flow.

Pressures Observed

The pressure transducers observed positive pressure and negative pressure events within each of these manholes; however, none of them exceeded 0.5 in w-c which is well below the safe pressure tolerance proposed for the clean water injection testing.

Overall Evaluation

As expected no significant pressures were recorded during this period. This was expected as the residential usage is low and is using a small percentage of the total sewer to transmit liquid flows. This leaves the remainder of the sewer that is unused by liquid to transmit air within the sewer system to equalize pressures within the sewer system.

MH-1

MH-1 is the terminal manhole into which the landfill discharges leachate. There is no other source of liquids to MH-1. As such, the flow in this manhole is known to be zero under present conditions. There is no flow meter installed in this manhole, therefore flow data from MH-4 is being utilized for comparison and has been overlaid onto attached Graph #5 of the pressures observed in this manhole.

MH-2

MH-2 receives flows from the reach between MH-1 and MH-2 as well as Guinevere Road. There is no flow meter installed in this manhole, therefore flow data from MH-4 is being utilized for comparison and has been overlaid onto attached Graph #6 of the pressures observed in this manhole.

MH-3

MH-3 receives flows from the reach between MH-2 and MH-3 as well as the upstream flow passing through MH-2. There is no flow meter installed in this manhole, therefore flow data from MH-4 is being utilized for comparison and has been overlaid onto attached Graph #7 of the pressures observed in this manhole

MH-5

MH-5 receives flows from the reach between MH-4 and MH-5 as well as all upstream flow passing through MH-4. There is no flow meter installed in this manhole, therefore flow data from MH-7 is being utilized for comparison and has been overlaid onto attached Graph #9 of the pressures observed in this manhole.

MH-6

MH-6 receives flows from the reach between MH-5 and MH-6 as well as all upstream flow passing through MH-5. There is no flow meter installed in this manhole, therefore flow data from MH-7 is being utilized for comparison and has been overlaid onto attached Graph #10 of the pressures observed in this manhole.

3 DIURNAL PATTERN

SCS collected five days of data from the flow meter in MH-7. In order to construct a diurnal flow pattern in MH-7, an average flow was calculated for each half hour period in the data set. The averaged flows are shown on the attached Graph #12. A comparison was performed between the diurnal flow pattern described above and a typical flow pattern under pre-COVID19 conditions. It was observed the patterns were similar; however, the MH-7 morning values were lower than found during the typical pattern, the afternoon flow rates were similar to the typical pattern, and the evening flows were not as low as the typical pattern. This may be in part due to the specific conditions in the neighborhood due to more people working and learning from home compared to the typical pre-COVID conditions. However, the flow pattern is similar to the conditions observed in neighborhoods throughout the states.

4 CLEAN WATER TESTING

As predicted by MTUD, the traditional diurnal flow pattern had smaller magnitudes of high use periods; instead, the flow appears to be more uniform throughout the day under current COVID conditions. The background residential flows during the hours that the clean water injection testing will occur, is expected to be between 5-15 gpm. Based on MH-7 flow results the peak flow experienced was around 25 gpm at 4:30 PM. As discussed previously these flow rates are relatively close to what was predicted. SCS does not recommend modifying the clean water injection flow rates based on this background monitoring data.

PROPOSED TESTING RATES

SCS recommends starting clean water injection testing at 45 gpm for a one hour duration which will likely result in total sanitary sewer flow of less than 70 gpm. The first clean water injection test is currently projected for Wednesday February 17th. Due to the length of time required to extract the pressure transducer and flow meter data, we are currently only projecting to be able to get one test done on this initial day. The test data and the background data will be downloaded after the first clean water injection flow rate of 45 gpm is completed and then submitted to applicable parties for review/analysis. SCS will process the data and make a recommendation for subsequent testing.

TESTING DAY ACTIVITIES

Based on the current weather we are hopeful to run the first clean water injection test on February 17, 2021. A timeline for the day's activities are provided here:

- 6:00 AM – 8:00 AM Setting up for hoses and valves to prepare for the test
- 8:00 AM - All parties meet at the entrance to the Landfill to discuss any last minutes questions
- 8:30 AM - Start 45 gpm clean water injection rate test for 1 hr

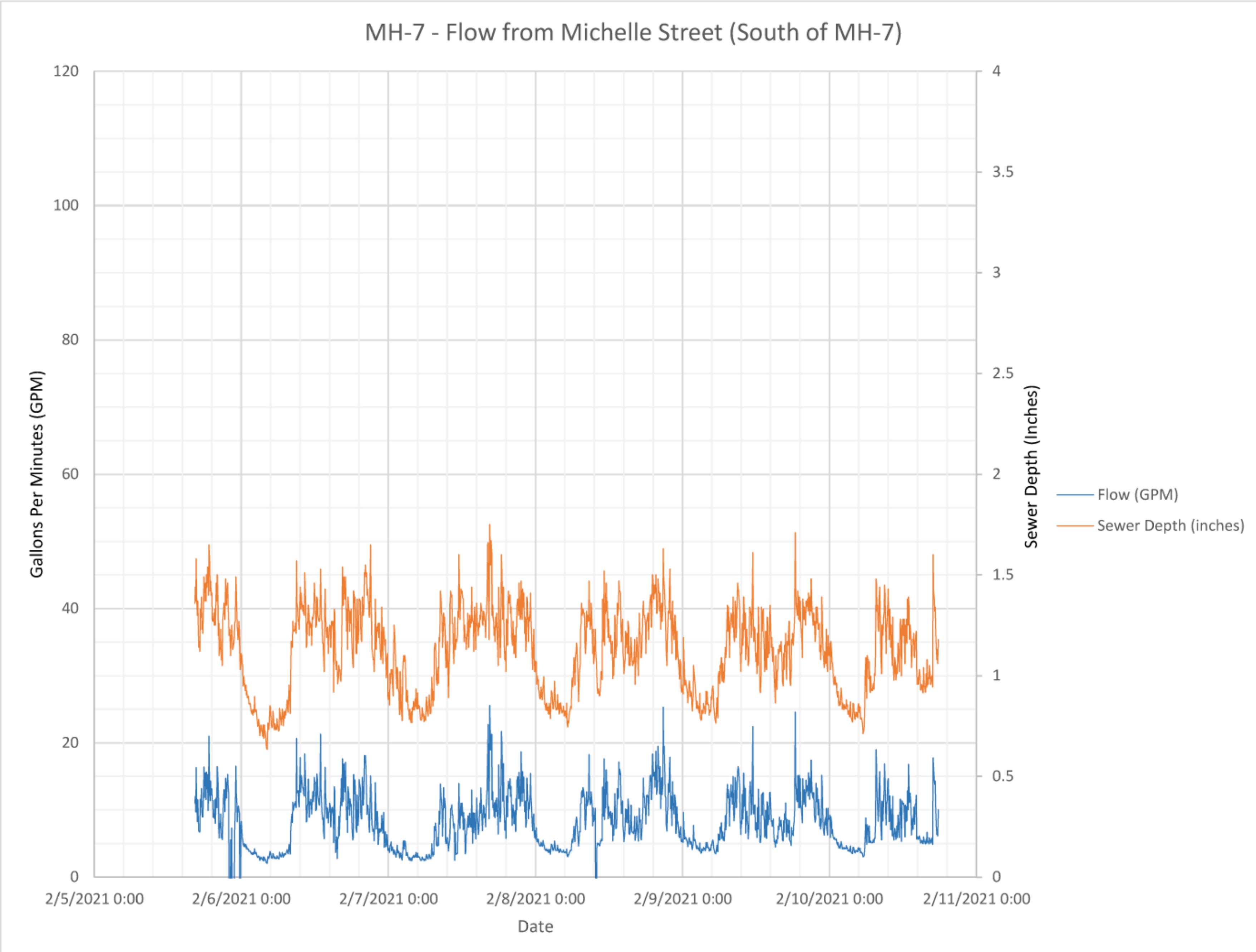
- 9:30 AM - Cease test and begin downloading data, servicing meters, and reprogram monitoring frequency
- 4:00 PM – Complete data download; finished for day

REPROGRAM PRESSURE TRANSDUCERS

Data collection from the monitoring equipment is expected to take significant time due to the volume of data points being recorded. The data indicate that the sanitary sewer system appeared to be operating normally for the monitoring period, without any significant pressure events observed. The monitoring equipment will be reprogrammed to take fewer readings between testing or leachate reintroduction events.

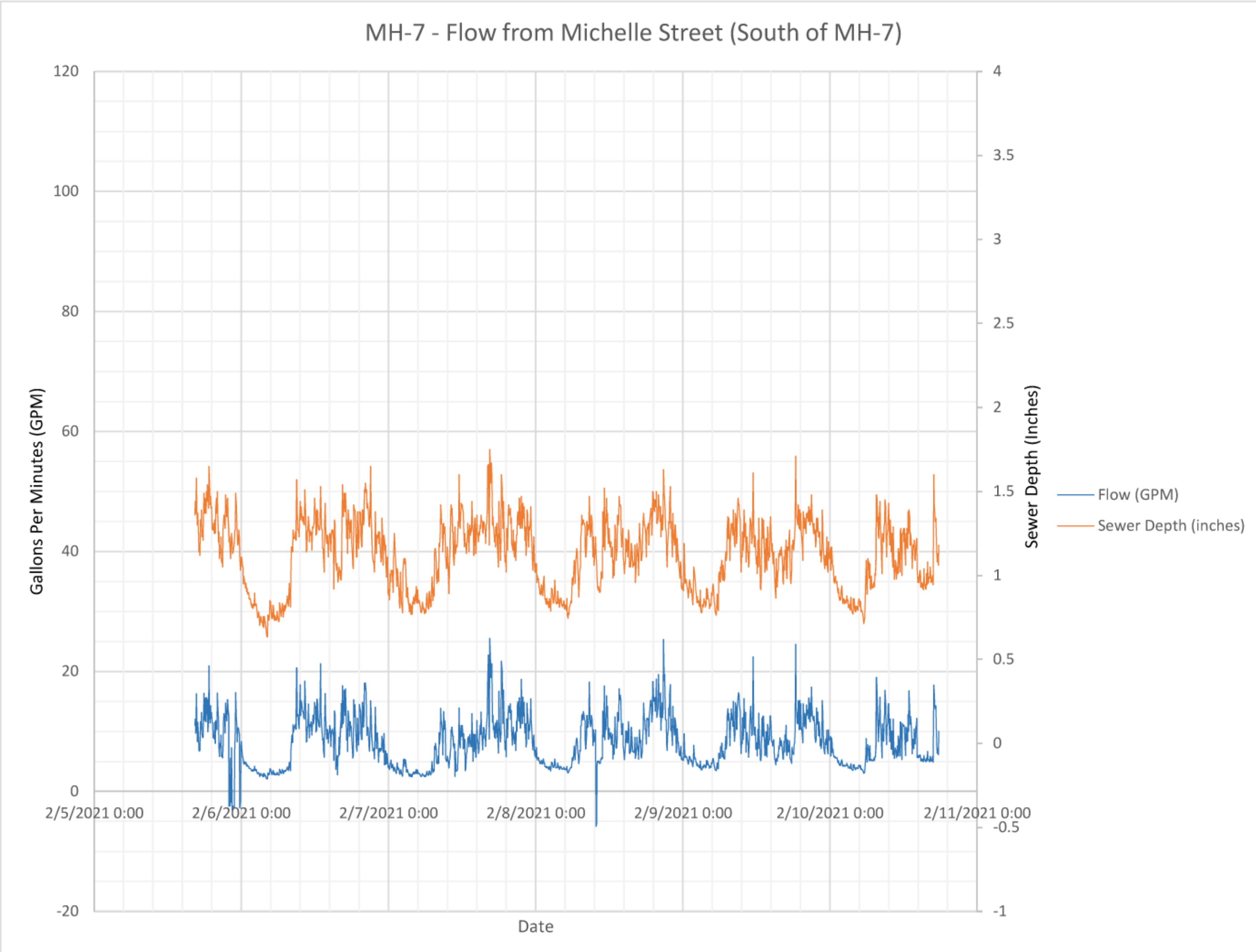
After the clean water injection testing on February 17, 2021 is completed all data will be collected from the monitoring equipment, which includes an additional week of background observations, and the pressure transducers will be reprogrammed to take a reading once every 15 seconds, which will match the maximum rate that the flow meters will record under any scenario. Prior to subsequent clean water injection testing the pressure transducers will be reprogrammed to resume 1-second monitoring during the testing. The transducers will again be reprogrammed after clean water injection testing to 15-second intervals. For the initial leachate reintroduction the meters can be reprogrammed to monitoring once a second.

GRAPH #1



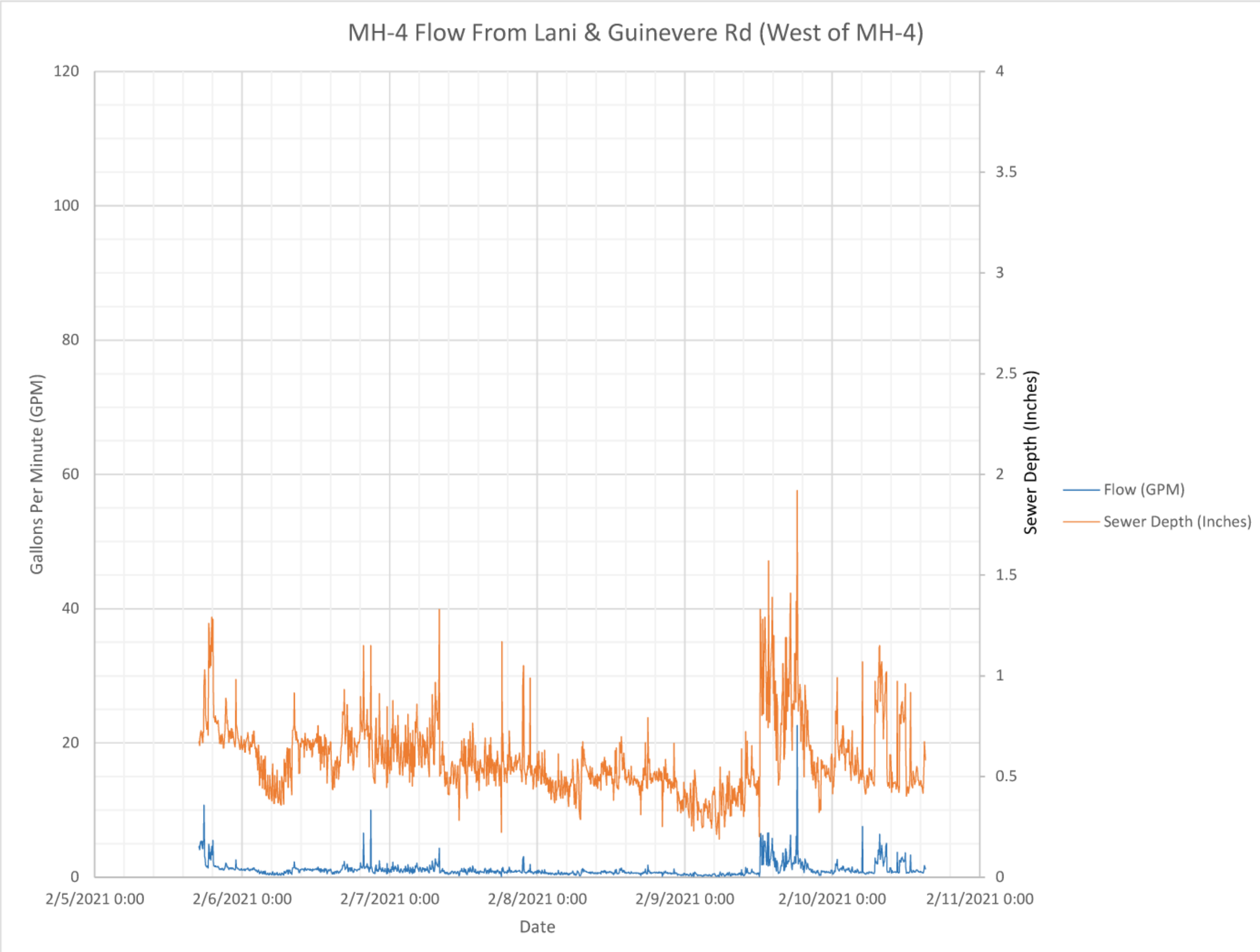
MH-7 - Flow from Michelle Street (South of MH-7)
Gallons Per Minutes (GPM)
120
100
80
60
40
20
0
Sewer Depth (Inches)
4
3.5
3
2.5
2
1.5
1
0.5
0
2/5/2021 0:00
2/6/2021 0:00
2/7/2021 0:00
2/8/2021 0:00
2/9/2021 0:00
2/10/2021 0:00
2/11/2021 0:00
Date
Flow (GPM)
Sewer Depth (inches)

GRAPH #2



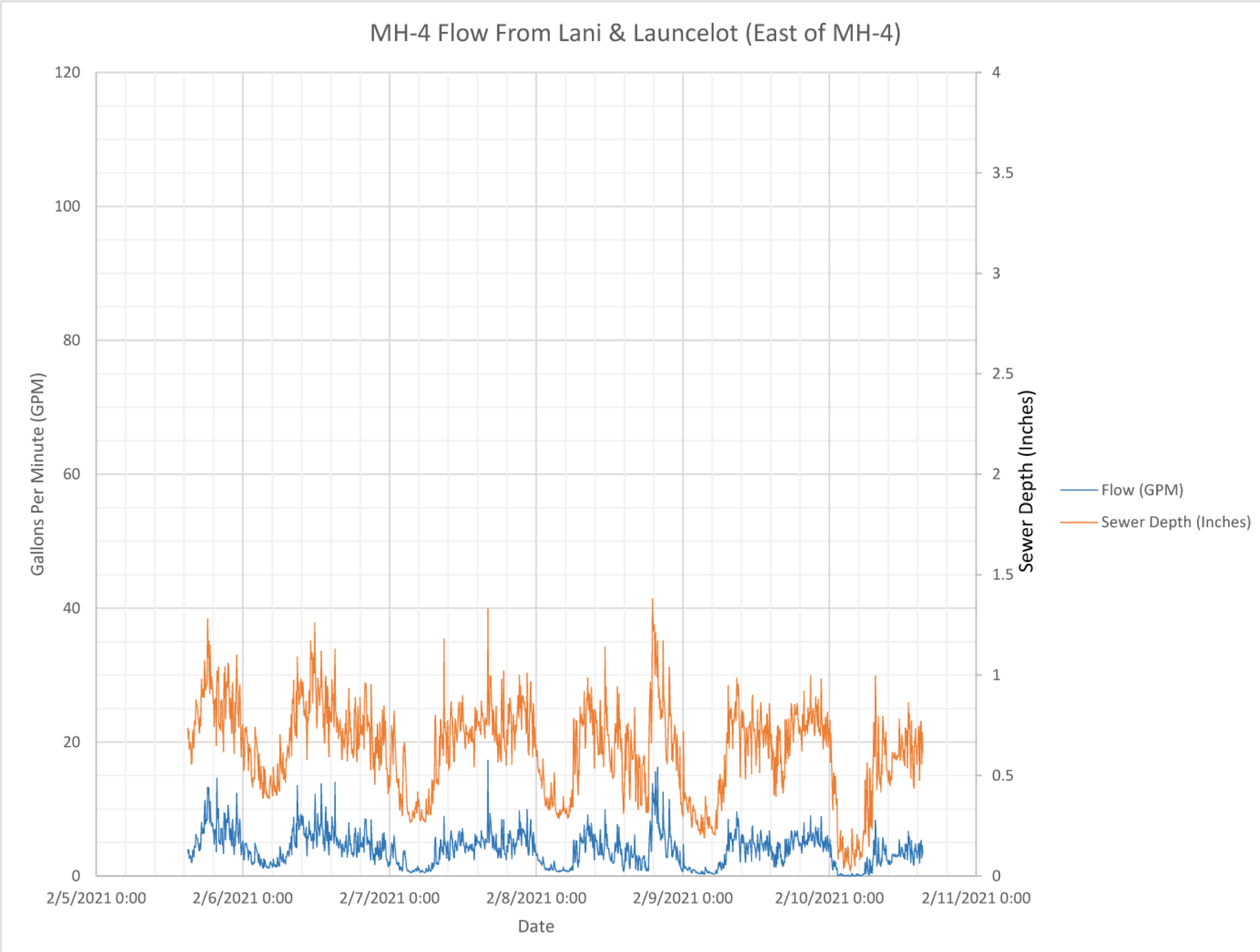
MH-7 - Flow from Michelle Street (South of MH-7)
Gallons Per Minutes (GPM)
120
100
80
60
40
20
0
-20
Sewer Depth (Inches)
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
2/5/2021 0:00
2/6/2021 0:00
2/7/2021 0:00
2/8/2021 0:00
2/9/2021 0:00
2/10/2021 0:00
2/11/2021 0:00
Date
Flow (GPM)
Sewer Depth (inches)

GRAPH #3



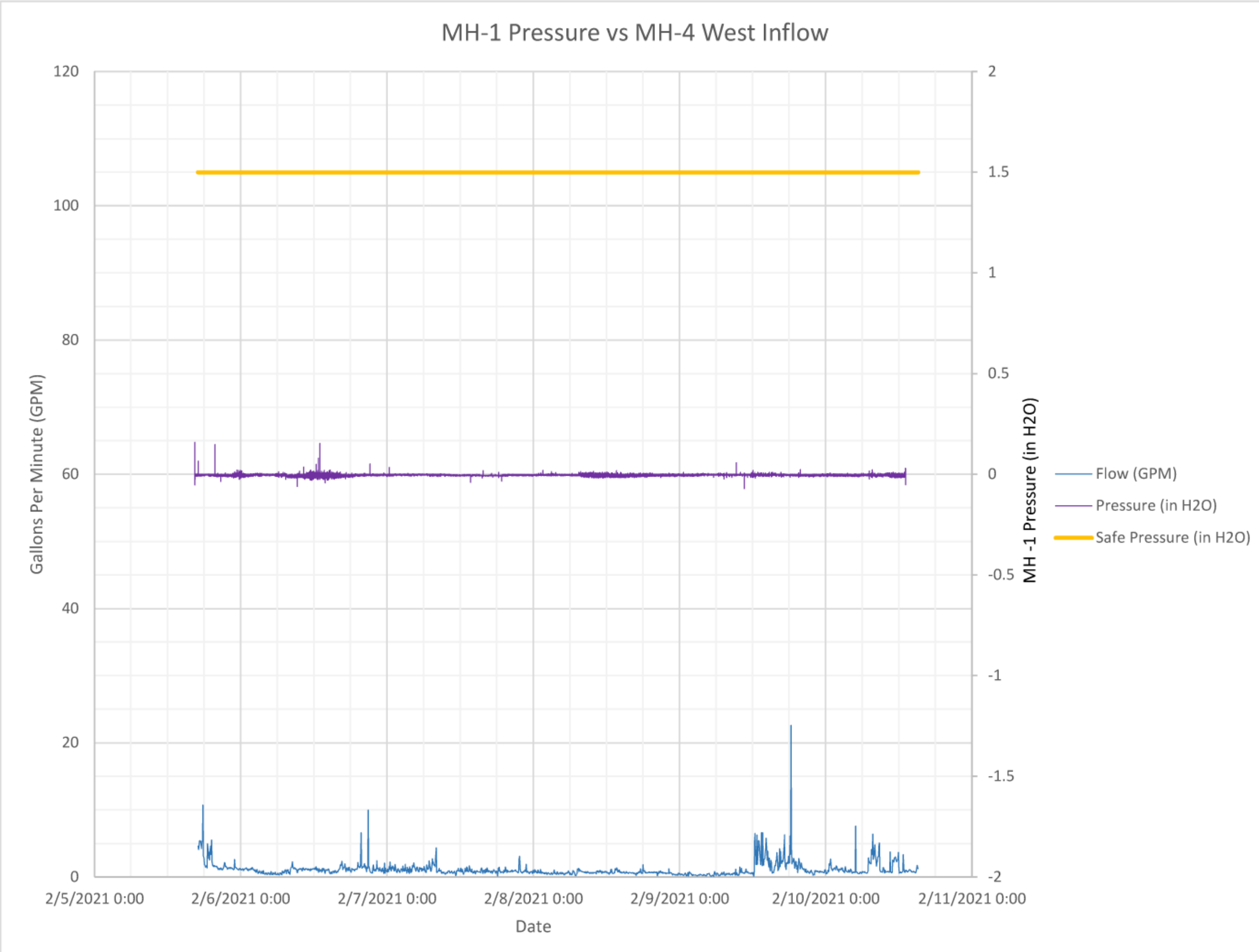
MH-4 Flow From Lani & Guinevere Rd (West of MH-4)
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
Sewer Depth (Inches)
4
3.5
3
2.5
2
1.5
1
0.5
0
2/5/2021 0:00
2/6/2021 0:00
2/7/2021 0:00
2/8/2021 0:00
2/9/2021 0:00
2/10/2021 0:00
2/11/2021 0:00
Date
Flow (GPM)
Sewer Depth (Inches)

GRAPH #4



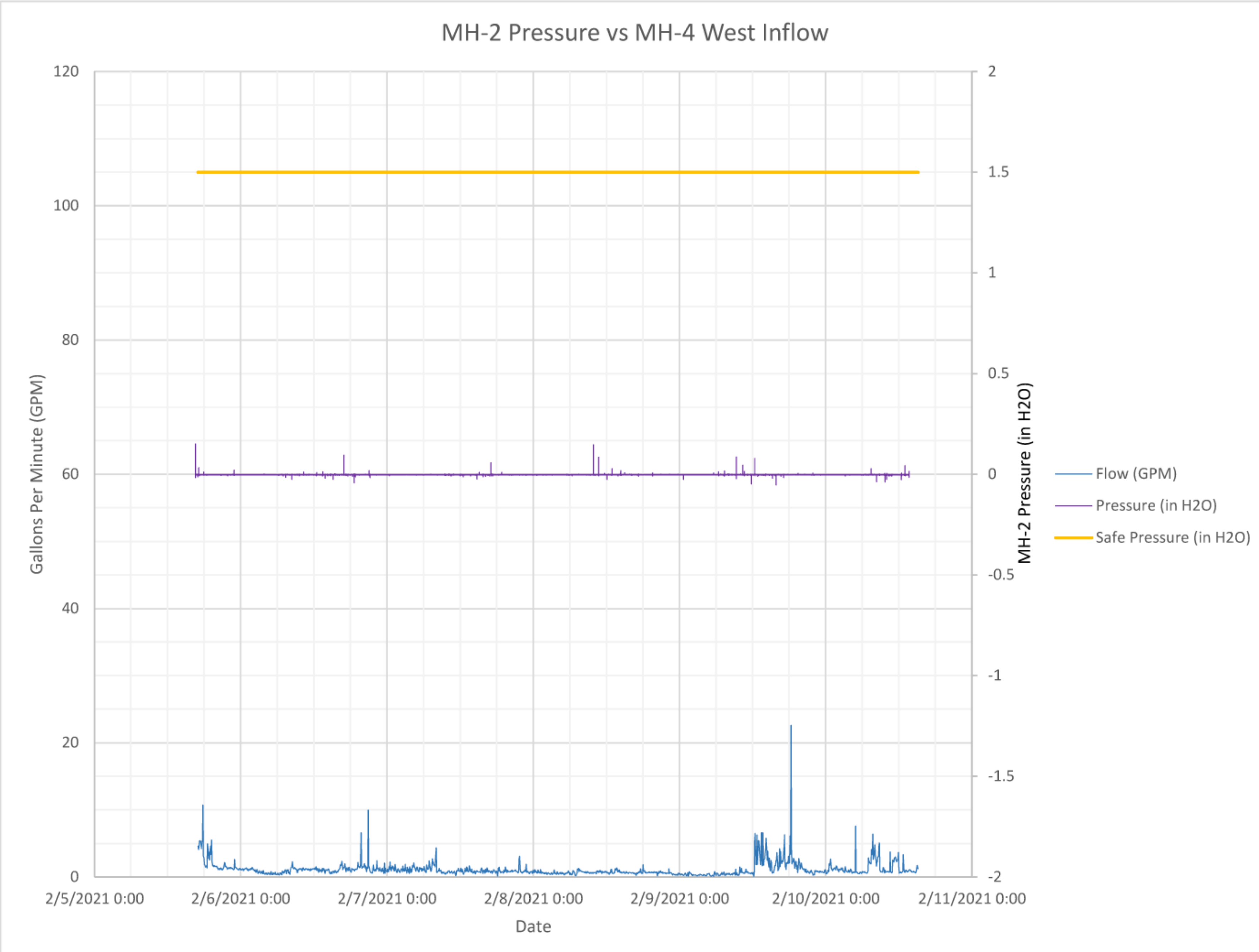
MH-4 Flow From Lani & Launcelot (East of MH-4)
120
100
80
60
40
20
0
Gallons Per Minute (GPM)
4
3.5
3
2.5
2
1.5
1
0.5
0
Sewer Depth (Inches)
2/5/2021 0:00
2/6/2021 0:00
2/7/2021 0:00
2/8/2021 0:00
2/9/2021 0:00
2/10/2021 0:00
2/11/2021 0:00
Date
Flow (GPM)
Sewer Depth (Inches)

GRAPH #5



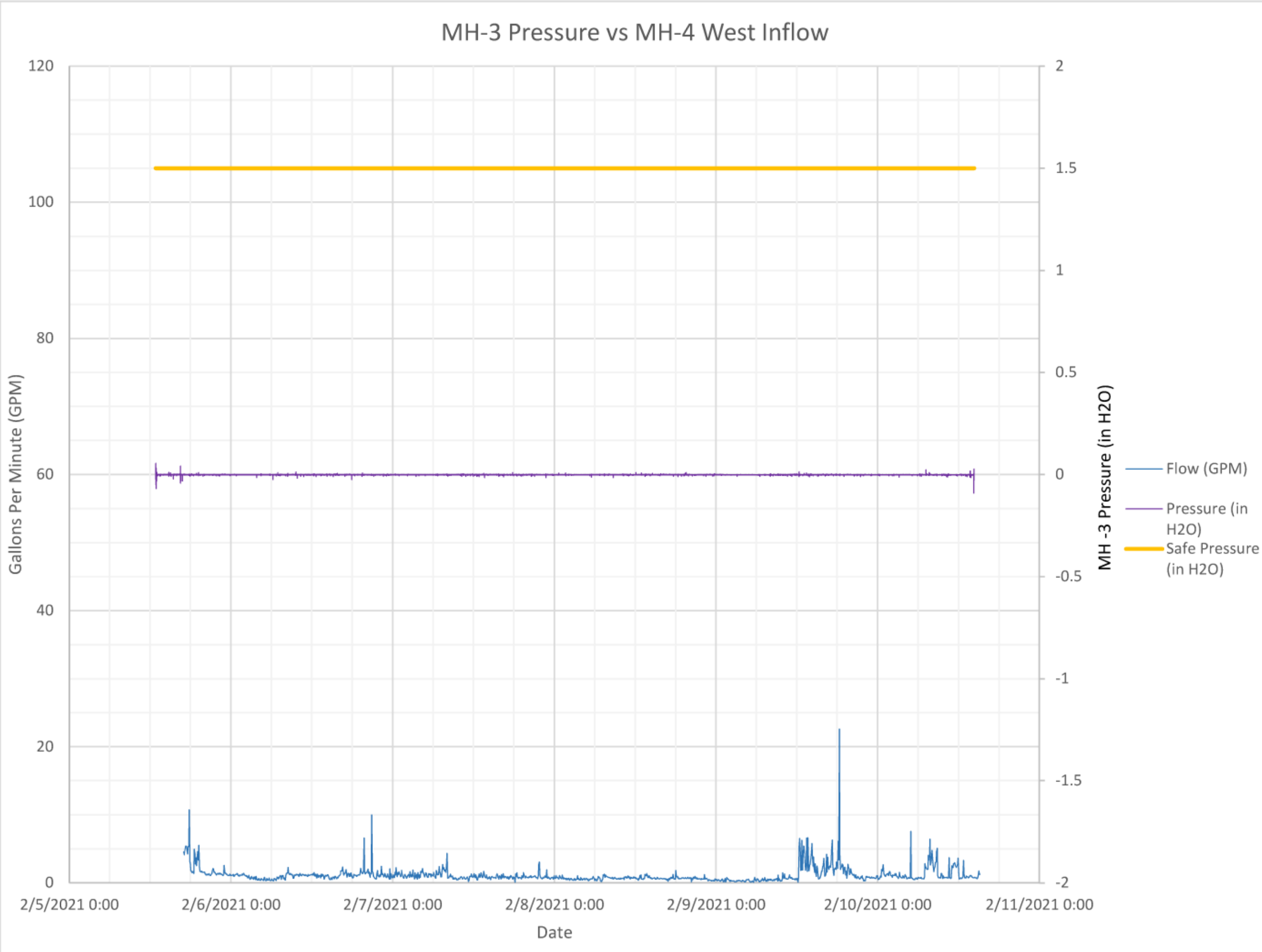
MH-1 Pressure vs MH-4 West Inflow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
MH -1 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
2/5/2021 0:00
2/6/2021 0:00
2/7/2021 0:00
2/8/2021 0:00
2/9/2021 0:00
2/10/2021 0:00
2/11/2021 0:00
Date
Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #6



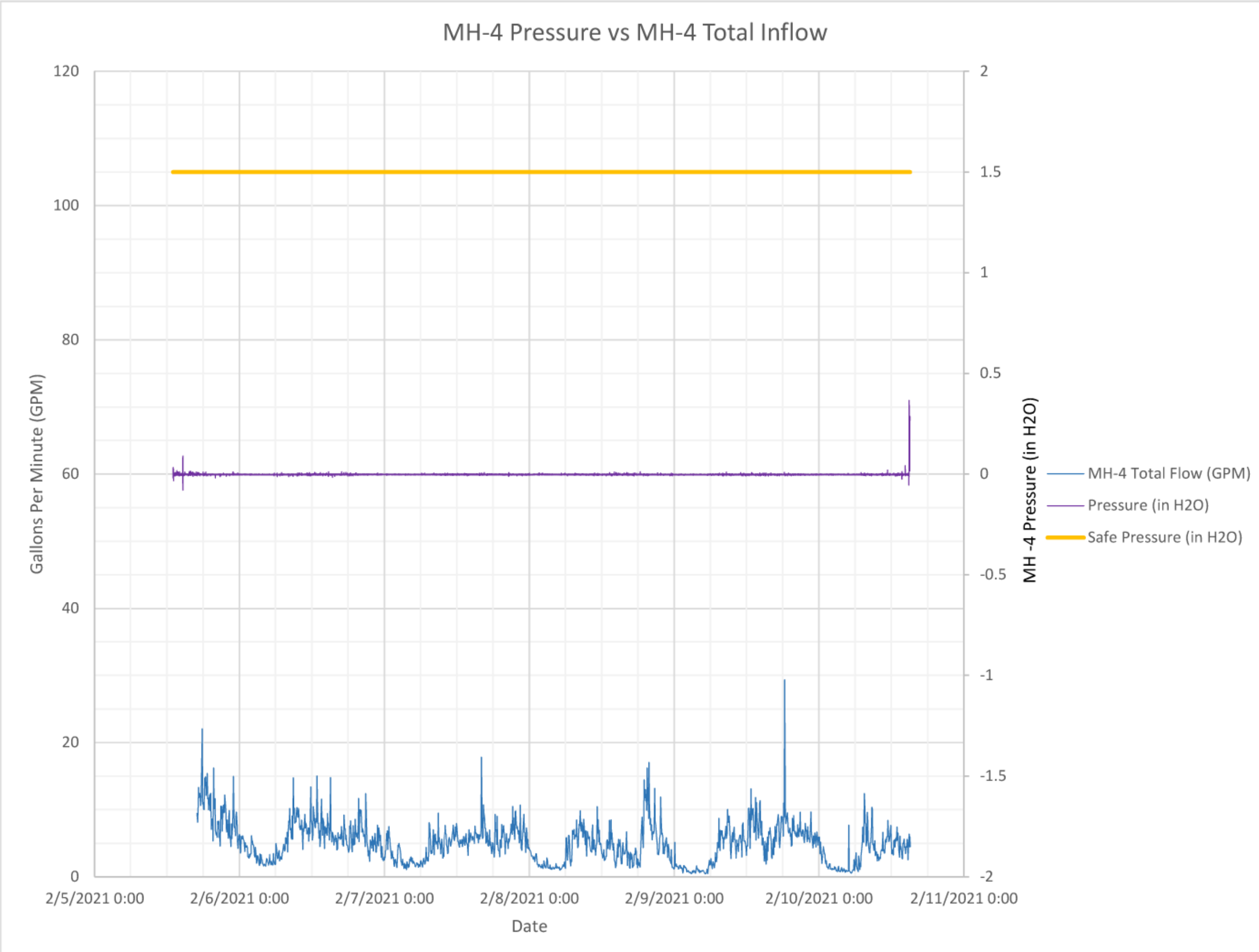
MH-2 Pressure vs MH-4 West Inflow
Gallons Per Minute (GPM)
MH-2 Pressure (in H2O)
120
100
80
60
40
20
0
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
2/5/2021 0:00
2/6/2021 0:00
2/7/2021 0:00
2/8/2021 0:00
2/9/2021 0:00
2/10/2021 0:00
2/11/2021 0:00
Date
Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #7



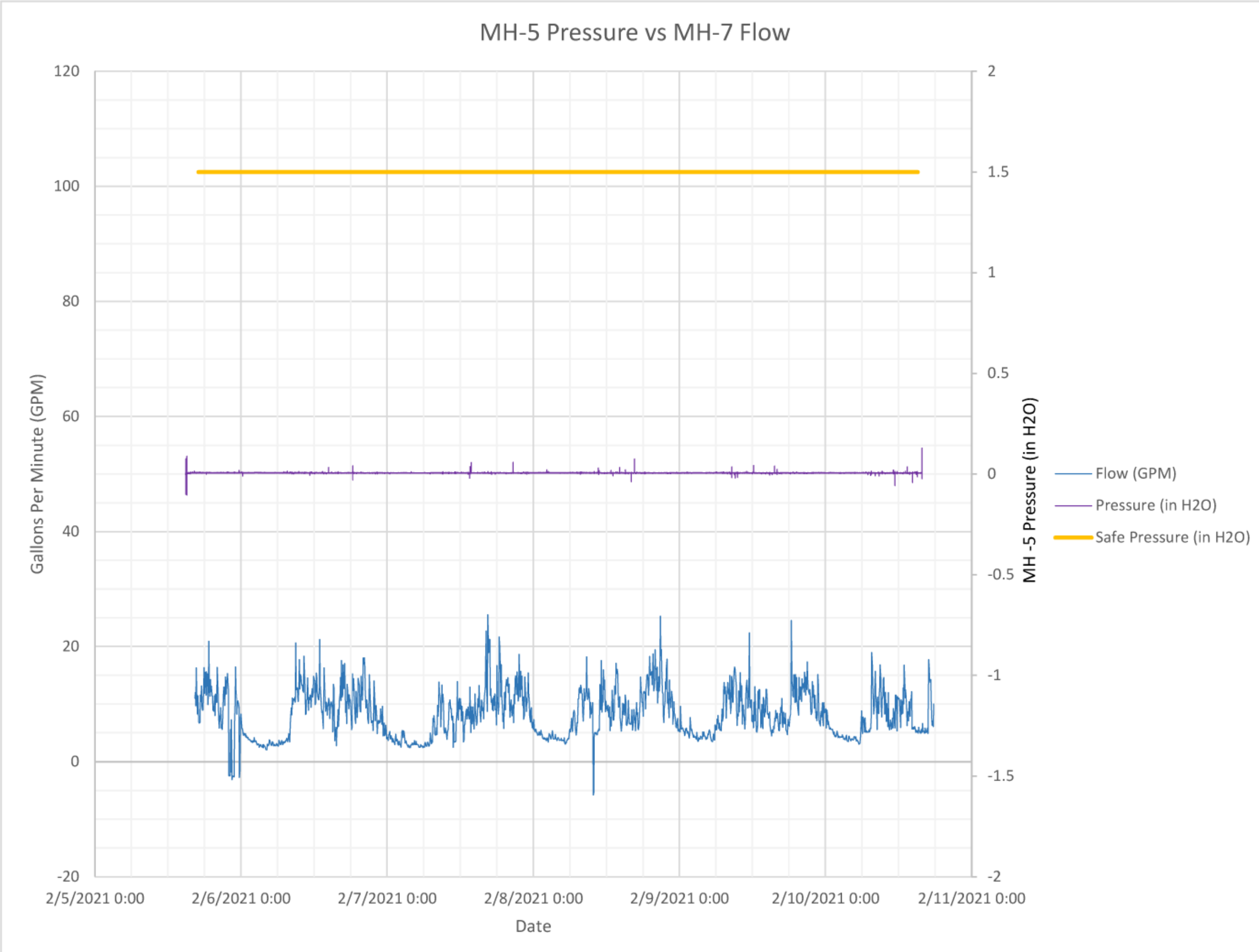
MH-3 Pressure vs MH-4 West Inflow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
MH -3 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
2/5/2021 0:00
2/6/2021 0:00
2/7/2021 0:00
2/8/2021 0:00
2/9/2021 0:00
2/10/2021 0:00
2/11/2021 0:00
Date
Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #8



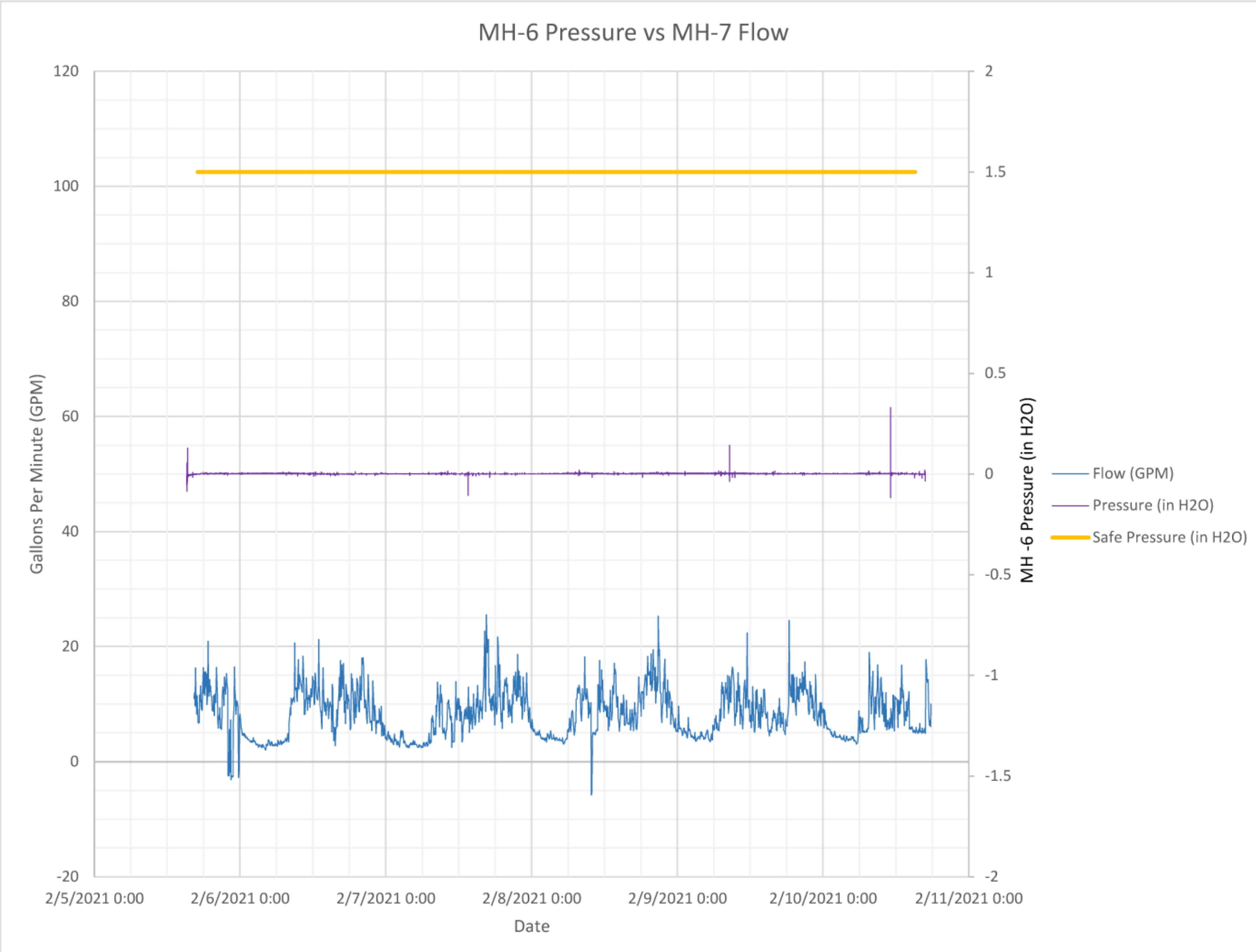
MH-4 Pressure vs MH-4 Total Inflow
120
100
80
60
40
20
0
Gallons Per Minute (GPM)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
MH -4 Pressure (in H2O)
2/5/2021 0:00
2/6/2021 0:00
2/7/2021 0:00
2/8/2021 0:00
2/9/2021 0:00
2/10/2021 0:00
2/11/2021 0:00
Date
MH-4 Total Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #9



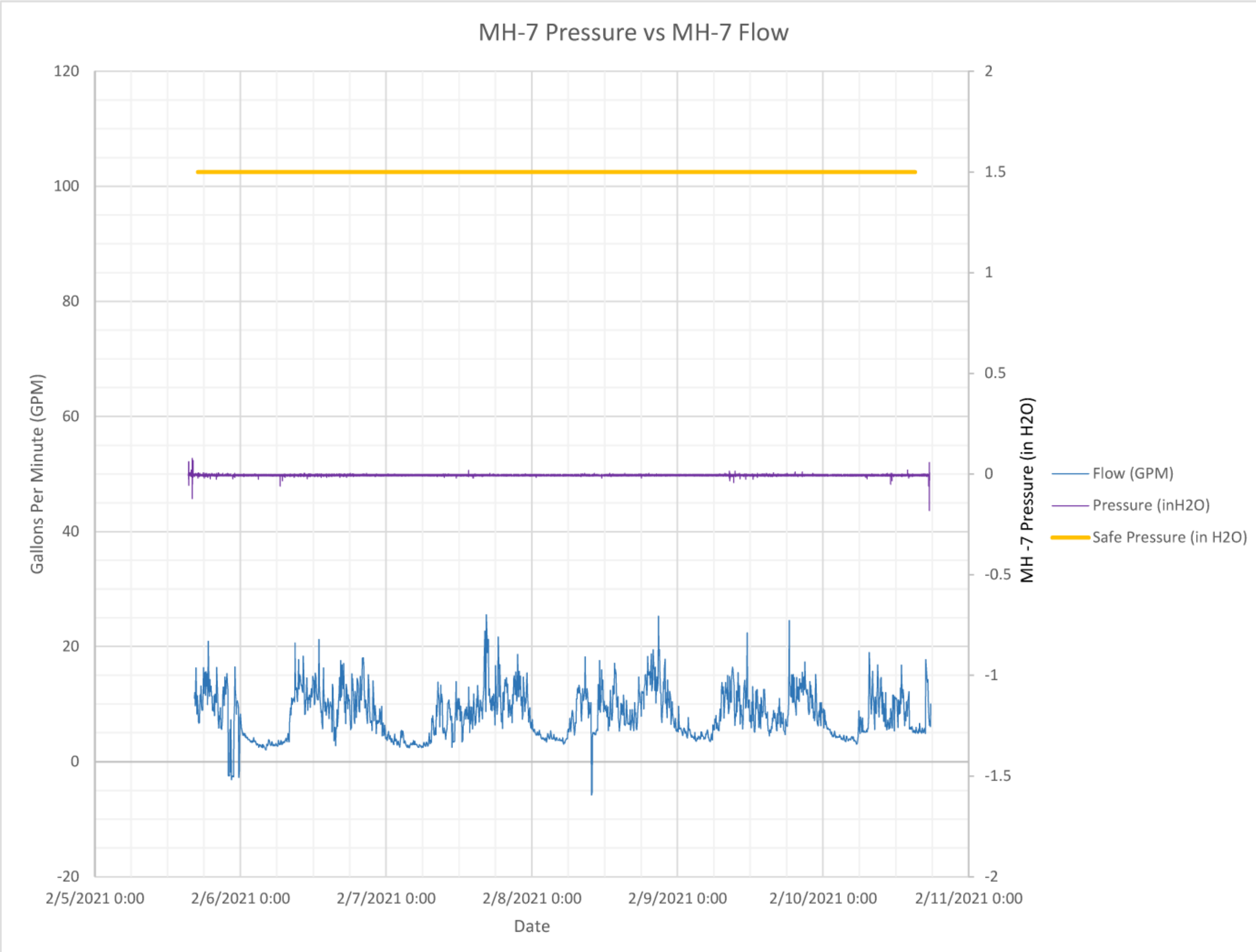
MH-5 Pressure vs MH-7 Flow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
-20
MH -5 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
2/5/2021 0:00
2/6/2021 0:00
2/7/2021 0:00
2/8/2021 0:00
2/9/2021 0:00
2/10/2021 0:00
2/11/2021 0:00
Date
Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #10



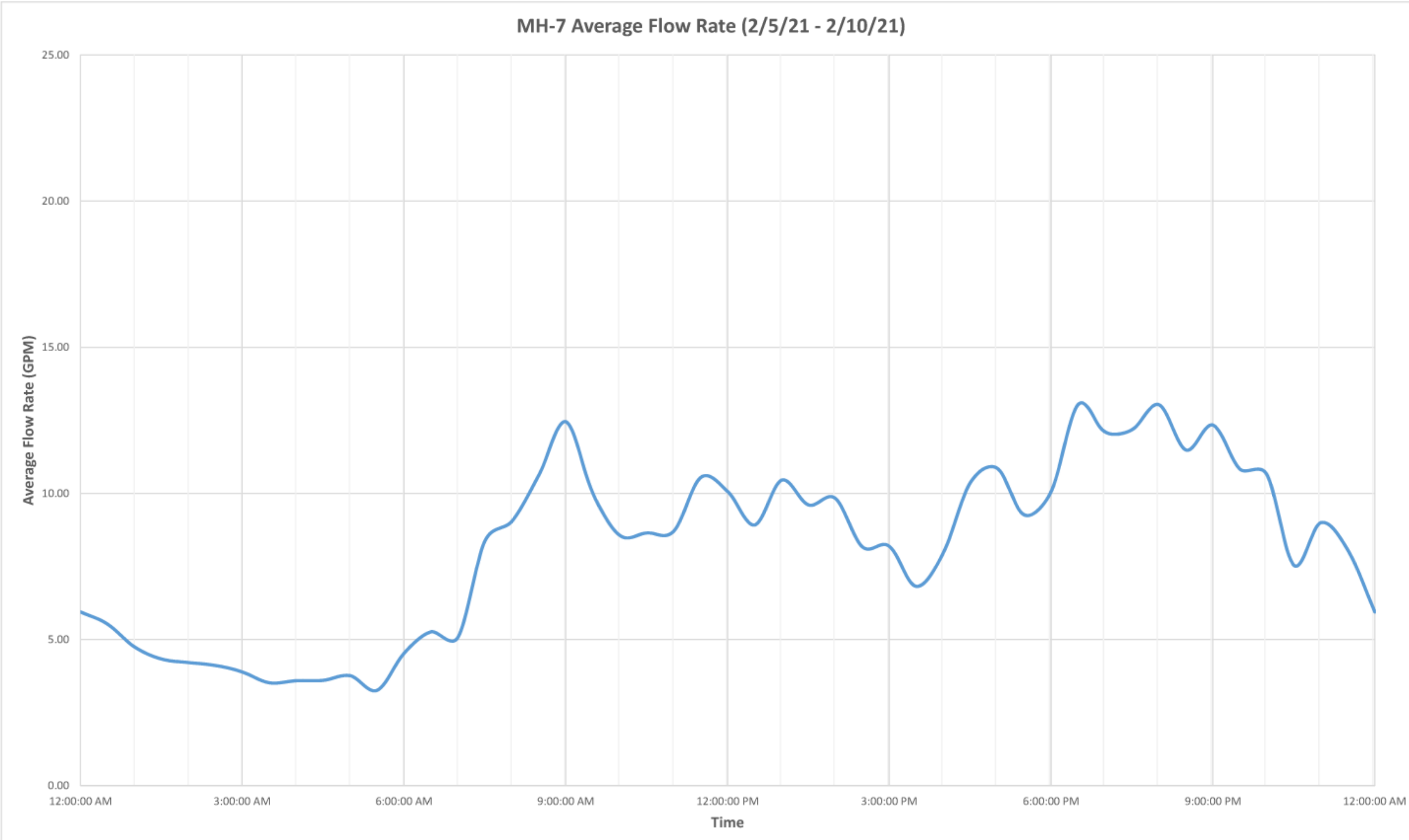
MH-6 Pressure vs MH-7 Flow
120
100
80
60
40
20
0
-20
Gallons Per Minute (GPM)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
MH -6 Pressure (in H2O)
2/5/2021 0:00
2/6/2021 0:00
2/7/2021 0:00
2/8/2021 0:00
2/9/2021 0:00
2/10/2021 0:00
2/11/2021 0:00
Date
Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #11



MH-7 Pressure vs MH-7 Flow
120
100
80
60
40
20
0
-20
Gallons Per Minute (GPM)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
MH -7 Pressure (in H2O)
2/5/2021 0:00
2/6/2021 0:00
2/7/2021 0:00
2/8/2021 0:00
2/9/2021 0:00
2/10/2021 0:00
2/11/2021 0:00
Date
Flow (GPM)
Pressure (inH2O)
Safe Pressure (in H2O)

GRAPH #12



MH-7 Average Flow Rate (2/5/21 - 2/10/21)
Average Flow Rate (GPM)
25.00
20.00
15.00
10.00
5.00
0.00
12:00:00 AM
3:00:00 AM
6:00:00 AM
9:00:00 AM
12:00:00 PM
3:00:00 PM
6:00:00 PM
9:00:00 PM
12:00:00 AM
Time

ATTACHMENT D

Leachate Reintroduction Plan

March 9, 2021
File No. 13213023.00

MEMORANDUM

To: Jacob Schmidt

FROM: Bret Clements, P.E. (KS 22717), Mark Pearson, P.E. (MO 2000155354), Christopher Woloszyn, E.I.T., Eric Peterson, P.E., Mike McLaughlin. (VA 020671)

SUBJECT: Leachate Reintroduction Plan

INTRODUCTION AND SUMMARY

On behalf of BFI Waste Systems of New Jersey, SCS Engineers recently completed flow and pressure monitoring of sewers near the Monroe Township Landfill (Landfill). The monitoring was performed in accordance with a Testing Plan ("Monroe Township Landfill Leachate Sewer Discharge," Attachment B, Final Revision dated 2/8/21, the "Testing Plan") developed by SCS, the Township, and its consultants, and included monitoring both during baseline conditions and during periods when clean water was discharged to the sewer to simulate leachate discharges in addition to baseline conditions.

Sewer Pressure Study

Once on February 17 and three times on March 2, we discharged significant amounts of clean water over a 60-minute period into the sewer to simulate releases of leachate from the landfill. We monitored pressures in the sewer both before and after clean water discharges to see if measured pressures in the sewer exceeded the pressure identified as "safe" in the Testing Plan (1.5 inches of water column pressure, or in. w.c). Clean water was discharged at 45, 60, 75 and 90 gallons per minute (gpm), and the tests were performed in the morning and over the noon hour.

Figure 1 shows the pressure data for Manhole (MH)-5 superimposed on the flow data from MH-7. MH-5 was the monitoring location with the largest magnitude of pressure changes (both positive and negative) during the study period. During the three clean water discharge events on March 2 of 60, 75, and 90 gpm, the recorded pressure at MH-5 varied between as much as +0.33 in. w.c. and as little as -0.33 in. w.c. These are far below the criterion of 1.5 in. w.c. established in the Testing Plan. In other words, adding up to 90 gpm of clean water to the sewer system did not increase pressure in the sewer above the safe pressure limit.

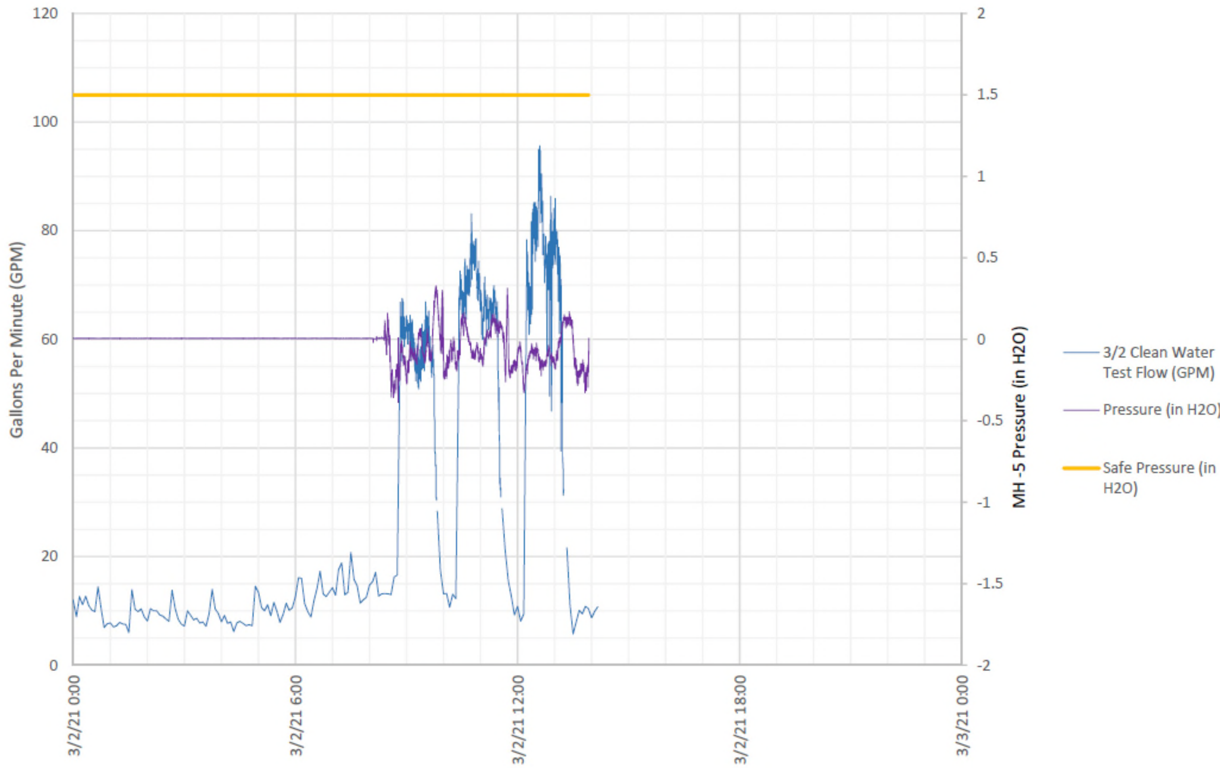


Figure 1. Pressure Recorded in MH-5 versus Flow Measured in MH-7

Diurnal Flow Patterns

We performed flow monitoring between February 5 and March 2, 2021, inclusive, in order to understand the normal variations in flow in the system under baseline conditions. In general, flows were mostly consistent throughout the day, although reductions in flow were seen in the early morning hours. Figure 2 summarizes flows in MH-7 and is typical of the flow observations during the study. Average flows at this location were between 10 and 15 gpm between about 7:30 AM and 11:00 PM, and fell to as low as an average of 5 gpm between 3:00 AM and 5:00 AM. Also shown in Figure 2 are the maximum flow rates over the study period; at MH-7, these are about 10 gpm higher than the average flows.

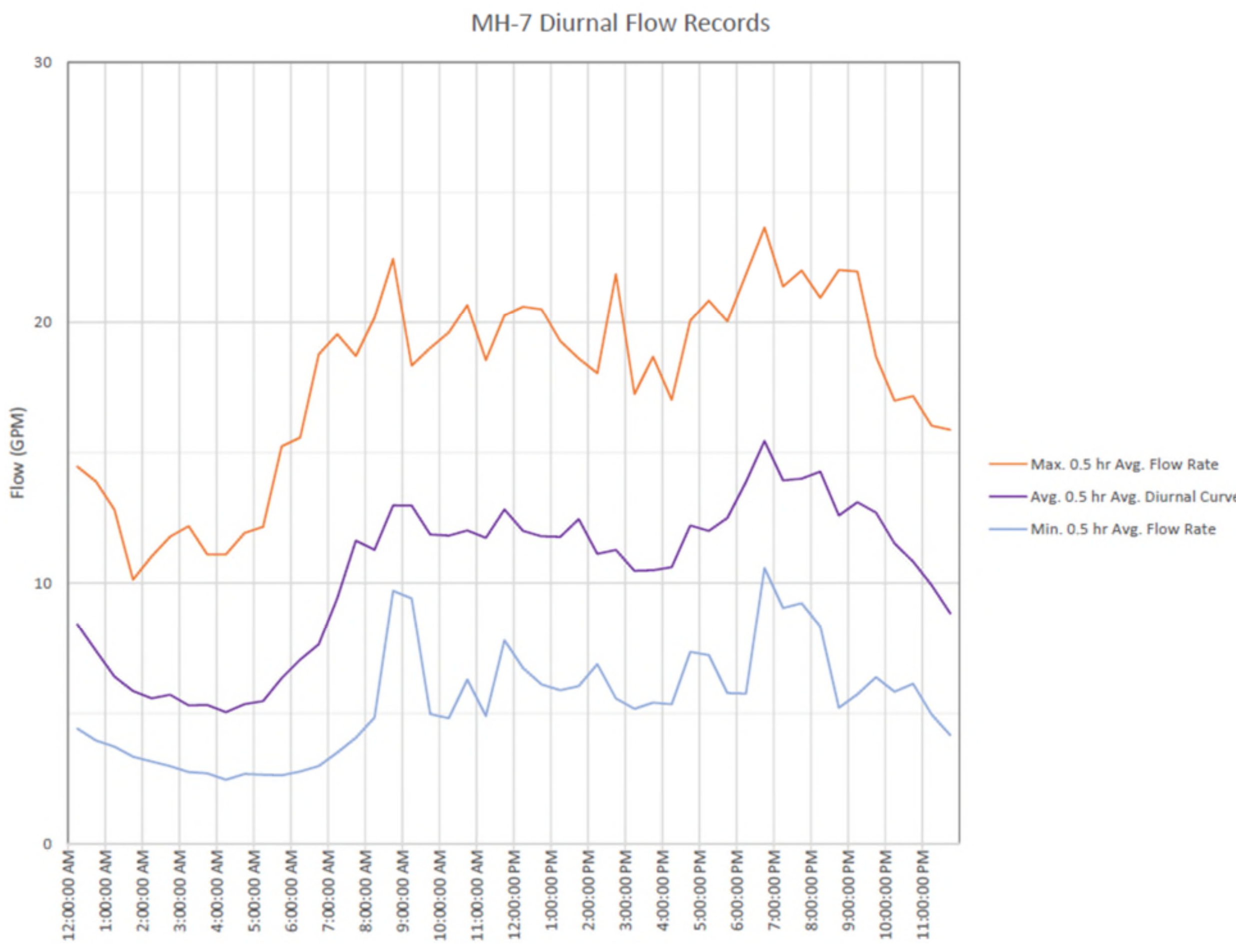


Figure 2. Diurnal Flows at MH-7 Over Study Period

Summary

The results of these tests indicate that the Landfill can safely inject up to 90 GPM into the sewer system for extended durations without causing pressurization events within the sewer system. The next phase of testing will involve leachate discharges at various flow rates not exceeding 90 gpm to confirm leachate can be safely discharged to the sewer for conveyance to the wastewater treatment plant. This is an important step towards eliminating (or greatly reducing) the need for trucks to haul leachate though the neighborhoods.

TESTING PLAN

The memorandum containing the Testing Plan addressed the landfill's history, including leachate generation, reported odors, and changes implemented. The initial review of the sewer system found that the sewers were in satisfactory condition and there was sufficient capacity to transmit leachate liquids through the sewer system.

However, there was some concern about the sewers' ability to efficiently transmit air within the sewer system without causing pressurization/depressurization of sewer gas (pressurization events) during higher flow periods. Pressurization events in excess of a typical residential sewer P-trap tolerances could let vapors from the sewer system pass into residential homes with faulty ventilation systems.

The Testing Plan proposed to temporarily install three flow meters and seven pressure sensors to monitor flows and pressures within the sewer system. Monitoring was to continue through the duration of the proposed testing and ending a few days after leachate reintroduction into the sewer system. The plan also included using a handheld sensor to measure if volatile organic compounds (VOCs) were escaping the sewer system around the manhole covers.

Referring to Figure 3, MH-1 through MH-7 each received a pressure sensor. MH-4 received two flow meters, one to monitor inflow from the east (flows from Launcelot Lane) and one to monitor inflow from the west (flows from Lani, Guinevere, and the Landfill). An additional flow meter was installed in MH-7 to monitor flows through MH-4 as well as flows from residences along Michelle Street.

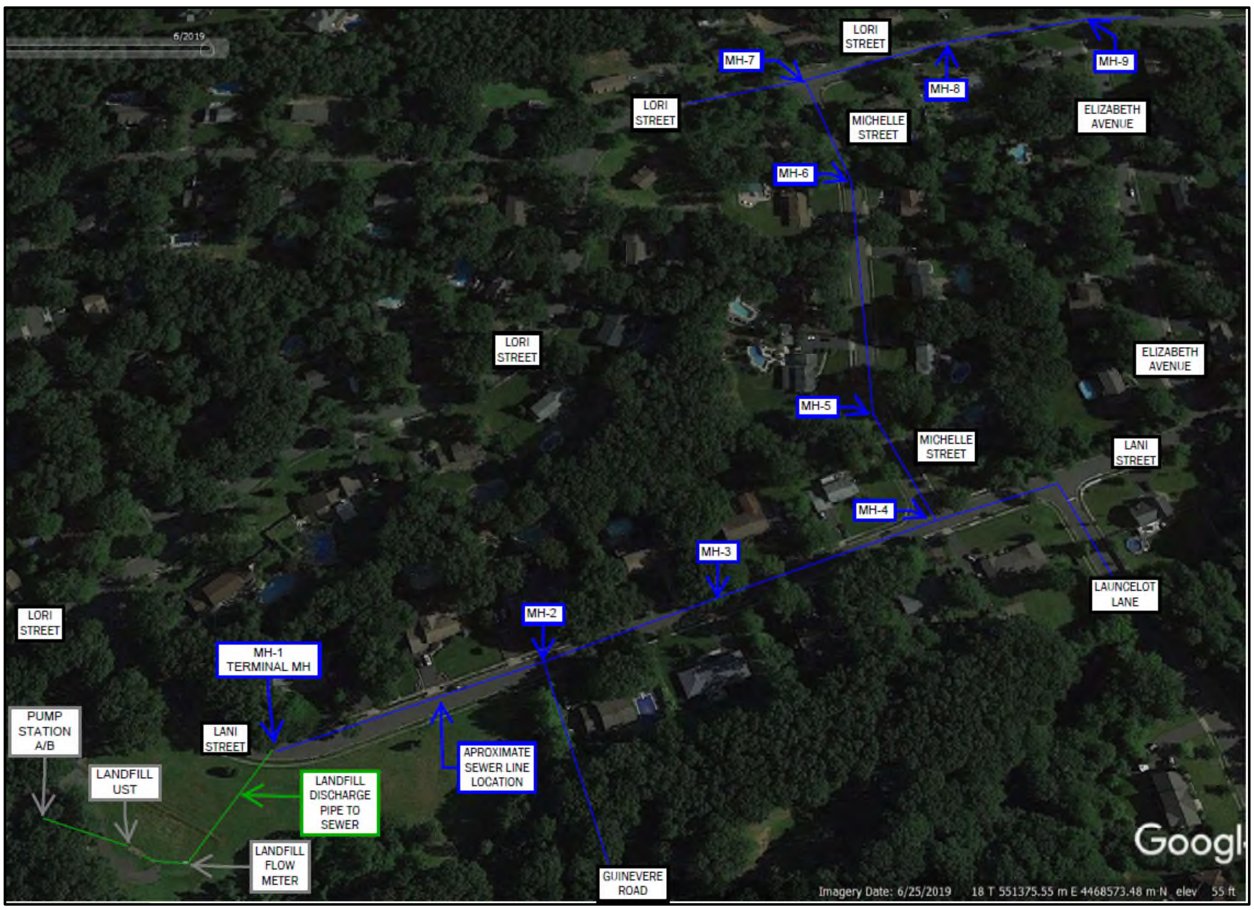


Figure 3. Site & Sewer Layout (Image from Google Earth)

BFI performed the initial phase of monitoring residential sewer flows during a background period when the Landfill was not discharging liquids into the sewer system. The second phase of the Testing Plan included injecting clean water into the sewer from the Landfill to simulate leachate flow at increasing rates of 45, 60, 75 and 90 gpm injected for one hour periods. The results of these tests are summarized in subsequent sections of this memo.

The MTUD, EPA, and NJDEP each reviewed the Testing Plan and provided comments which were addressed prior to finalizing the Testing Plan and implementing the background monitoring and clean water testing.

SEWER MONITORING

A previous memo *MTUD Sewer MH-1 through MH-7 Background Flow & Pressure Analysis 2/5-10/2021* dated and distributed on 2/15/21 (Initial Background Memo) discussed the first 5 days of background monitoring and confirmed that the clean water testing should proceed as originally planned. This section provides continued discussion from that memo and addresses additional flow and pressure monitoring observed since.

Flow Records

Graphs showing the flow records for MH-4 West, MH-4 East, and MH-7 over the duration of the monitoring period 2/5/21 through 3/2/21 are included in Attachment F and discussed in Attachment E to this memo. This time frame includes background monitoring as well as clean water injection testing at 45 gpm on 2/17/21 and at 60, 75, and 90 gpm on 3/2/21. Attachment G discusses challenges faced during testing and how they were resolved; these challenges did not compromise the overall test objectives.

It appears the temporary flow meters may have under-reported flows in the sewer during the clean water tests, based on a comparison of those flow results and the known clean water flow rates as measured on March 2 by the permanent and recently calibrated flow meter at the Landfill (60, 75, and 90 gpm). These known flow rates should have been added to background (13 to 20 gpm) and the total flow reflected in the flow rates reported by the meters. But as shown in the Attachment F graphs, total flows reported were less than expected flows. We know what flows of clean water were introduced to the sewer even if the temporary flow meters did not correctly report them.

Pressure Records

Graphs showing the pressure records for MH-1 to MH-7 over the duration of the monitoring period 2/5/21 through 3/2/21 are included in Attachment F and discussed in Attachment E to this memo. This time frame includes background monitoring as well as clean water injection testing at 45, 60, 75, and 90 gpm. As discussed in Attachment G, there were some challenges with pressure monitoring that had to be addressed during the testing period. Again, these challenges did not compromise the overall test objectives.

Diurnal Curves

The diurnal curve for each flow meter is included in Attachment F. Attachment E discusses these curves. Each diurnal curve was calculated by dividing the day into 30 minute intervals and averaging all the flow data collected for each interval. For example, midnight to 12:29 AM had 6 readings at 5-minute intervals over this period, this average was then plotted at 12:15 AM (the midpoint of the interval). Data anomalies were excluded from the diurnal curve plots. Anomalies were periods of missing data, data during clean water testing, and sustained abnormal flow readings.

The diurnal curve shown on Figure 2 above for MH-7 (the manhole in the study area furthest from the landfill) is the most representative of residential usage of the sewer system during the study period. Generally the curves indicate decrease sewer usage from 10 PM to 7 AM along with decreased variability during these periods. From 7 AM to 10 PM the average and maximum average usage of the sewer idles around 13 GPM and 20 GPM respectively.

Photoionization Detector Screening Results

We monitored air from the manhole covers for VOCs during background monitoring and clean water testing using a photoionization detector (PID). No VOCs were detected above natural background concentrations.

SUMMARY OF FINDINGS

Based on the investigation summarized above and in the Attachments, the sewer system has ample capacity to support current residential usage and sufficient capacity to convey Landfill leachate discharge rates of up to 90 gpm without creating significant pressurization events in the sewer system.

The clean water testing has demonstrated that sustained liquids injection from the Landfill of 45, 60, 75, and up to 90 gpm can safely be discharged into the sewer system without causing unacceptable pressurization within the sewer system. In addition there were no minor pressures observed climbing over the 1-hour duration of each clean water test, which indicates that longer durations of sustained pumping are also unlikely to cause pressurization events within the sewer system that would exceed the safe pressure.

NEXT STEPS

The plan is to continue the stepwise approach to reintroducing leachate into the sewer system. Among the first steps planned, BFI will be calibrating the new variable frequency drive (VFD), which will control the existing permanent pump in the underground storage tank (UST). This will be followed by careful reintroduction of leachate and confirmation testing.

Calibration of VFD and Pump

The new VFD was installed to control the leachate discharge rates into the sewer system. Prior to leachate reintroduction BFI, will reinstall the pump into the UST to perform startup pump and VFD testing. Minimal leachate is expected to be discharged from the UST during this calibration/testing event. BFI will provide calibration records for both the flow meter and VFD/pump configuration to interested parties.

Initial Leachate Reintroduction and Testing

BFI proposes to commence initial leachate reintroduction to the sewer at 9 AM on March 15, 2021. This will provide interested parties time to review pressure and flow data and for BFI to calibrate the VFD and pump. Initial leachate reintroduction into the sewer system will be limited to 45 gpm with discharge events occurring as required.

Sometime in the following week, BFI will propose a day to perform confirmatory testing to verify that leachate reintroduction into the sewer can be safely performed at 60, 75, and 90 gpm.

BFI's consultants will monitor sewer manhole covers for VOCs using a PID. The temporary flow meters and pressure sensors will remain in place and be serviced by BFI and their subcontractors until the end of March. At the end of the period, data will be compiled, analyzed, and distributed to all interested parties.

A technical meeting is recommended to discuss alternative meters and flow monitoring locations that should be considered for the post-reintroduction period. Additional monitoring will aid in confirming the residential usage of the sewer system and will aid in helping the Landfill adapt as COVID restrictions are reduced and more traditional diurnal patterns form. The Landfill will reprogram their pump system as necessary to continue to operate safely.

Truck Hauling & Storage Tanks

Assuming that leachate reintroduction into the sewer is accomplished at reasonable levels, truck traffic to haul leachate will be discontinued as soon as practical. The on-site storage tanks will be removed from the site when they are no longer required. BFI will prepare documents to propose a reasonable amount of storage to be kept on-site based on various extenuating circumstances and changes that have or will be implemented.

Landfill Cover

The Landfill will continue to monitor the final cover system in accordance with regulatory requirements and will make improvements to decrease storm water infiltration as required. The assessment and improvement recommendations will be completed under a task separate from this leachate reintroduction evaluation.

ATTACHMENT E

Discussion of Data

DATA DISCUSSION

Presented below is a discussion of the date presented on the graphs included in Attachment F.

Flow Data

<u>Graphs #1-3</u>
Show the continuous recorded flow information for each flow meter from 2/5 through 3/2/21.

<u>Graphs #4-6</u>
Show the continuous recorded flow information for each flow meter from 2/5 through 3/2/21 superimposed onto a one-day period for each flow meter. Each clean water test has been called out.

<u>Graphs #7-9</u>
Show the average diurnal curve along with the minimum and maximum half-hour average flow rate from 2/5 through 3/2/21 for each flow meter. See the diurnal curve section below for additional detail on how these data were calculated.

MH-7 shows the daily diurnal curve for this analyzed portion of the sewer system. The flow is fairly constant throughout the day with slight decreases during the early morning hours. The maximum and minimum half-hour average flow rates show the highest and lowest average flow rate during each 30-minute period during the study. The background residential usage should be in this range, and we refer to this range as the “expected background range”.

<u>Graphs #10-12</u>
Show the clean water test flow rates from 2/17/21 and 3/2/21 mapped with the diurnal curve along with the expected background range shown in Graphs #7-9.

<u>Graphs #13-15</u>
Are the same as Graphs #10-12 but are focused on the period from 8 AM to 2 PM to clearly show the recorded flows versus the expected background levels.

Graph #13 and #15 show MH-4 west and MH-7, it is unclear why these temporary flow meters did not properly record the flows in the sewer system during the clean water testing. The permanent on-site flow meter during testing showed clean water being injected into the sewer at 60, 75, and 90 gpm. A temporary flow meter was used for the 45 gpm clean water test.

Graph #14 shows an increase of flows at the same time as clean water testing on 3/2. It is unclear why there are minor increases in flow during these periods as it is not along the path of the clean water being injected into the sewer. The levels and velocity recorded in the sewer did not indicate a backflow condition or substantial increase in head within this sewer.

Pressure Data

Each of Graphs #16-35 show the recorded pressure observed in each manhole as specified. For convenience the documented flow recorded by the flow meter in the sewer at the first downstream manhole is shown on each of these graphs as well. Each graph also shows the “Safe Pressure” which is set at 1.5 inches of water column (in w-c). As long as each residential home has properly operating P-trap for each drain and sewer pressures remain below this “Safe Pressure” then sewer gases should not enter residences through sewer pipes.

The first in each series of graphs shows the entire duration, while the second and third of each series show a narrow excerpt taken during clean water testing performed on 2/17 and 3/2, respectively.

<u>Graphs #16-18</u>
Show recorded pressures observed in MH-1 compared to the flow being monitored at the west inflow of MH-4.

- Graph #16 clearly shows that no substantial pressurization events occurred during the background and clean water testing performed to date.
- Graph #17 shows the clean water test of 2/17 shows a slight pressurization event when compared to background pressures but is still far below the safe pressure limit.
- Graph #18 shows the clean water tests of 3/2 and a slight pressurization event when compared to background pressures but it still far below the safe pressure limit.

<u>Graphs #19-21</u>
Show recorded pressures observed in MH-2 compared to the flow being monitored at the west inflow of MH-4.

- Graph #19 clearly shows that no substantial pressurization events occurred during the background and clean water testing performed to date. Note that the data from 2/17 through 2/23 was inadvertently deleted while trying to download the data.
- Graph #20 shows the clean water test of 2/17 and does not show any significant pressurization events.
- Graph #21, shows the clean water tests of 3/2 and does not show any significant pressurization events.

<u>Graphs #22-24</u>
Show recorded pressures observed in MH-3 compared to the flow being monitored at the west inflow of MH-4. On 2/23 we replaced the pressure sensor originally placed in this manhole with the sensor originally placed in MH-4 because the former appeared to be faulty. Our suspicions were confirmed, and the data from the faulty sensor were not included on these graphs.

- Graph #22 clearly shows that no substantial pressurization events occurred during the background and clean water testing performed to date.
- Graph #23 shows the clean water test of 2/17 and does not show any significant pressurization events.
- Graph #24 shows the clean water tests of 3/2 and does not show any significant pressurization events.

<u>Graphs #25-26</u>
Show recorded pressures observed in MH-4 compared to the flow being monitored at the inflow of MH-7. The pressure sensor from this manhole started reporting erroneous data on 2/12 and never recovered. The sensor from MH-3 was placed in this manhole on 2/23 and subsequent pressure readings were consistent with background prior to the start of the erroneous readings. A functioning pressure sensor was not in place during the first clean water test on 2/17; therefore, no graph is included for the first clean water test.

- Graph #25 shows a pressurization event well below the safe pressure limit. The erroneous data that started on 2/12 are shown plotted in a red dashed line. These erroneous data are not representative of actual sewer conditions.

- Graph #26 shows the clean water tests from 3/2 and some low pressurization (vacuum) events. The event prior to the start of increased flows is likely from downloading and reprogramming this sensor before the start of testing. There are no significant pressurization events that appear to be caused by the increase in flows.

Graphs #27-29
Show recorded pressures observed in MH-5 compared to the flow being monitored at the inflow of MH-7. MH-5 is of interest, as this manhole contains a drop within the manhole; however, the pressures within this manhole do not appear to have been significantly affected by this testing.

- Graph #27 clearly shows that no substantial pressurization events occurred during the background and clean water testing performed to date.
- Graph #28 shows the clean water test of 2/17 and does not show any significant pressurization events.
- Graph #29 shows the clean water tests of 3/2 and increased pressurization activity during the day of testing but the observed pressures are still well below the safe pressure limit.

Graphs #30-32
Show recorded pressures observed in MH-6 compared to the flow being monitored at the inflow of MH-7. MH-6 is of interest, as this manhole is the first manhole downstream of MH-5 and its drop structure.

- Graph #30 appears to have minimal pressurization events within the sewer, but from 2/12 through 2/21 the sensor detects multiple pressurization events. None of these events corresponded to the clean water test periods, nor do they approach the safe pressure limit. After 2/21, the pressure appears to return to normal background conditions. It is unclear what caused the sensor to detect these pressurization events and if these events actually occurred in the sewer or if the sensor was malfunctioning. Note the vacuum event that occurred near midnight on 2/20 is not of significant concern because such a vacuum event would cause air to be drawn into the sewer and would not cause sewer gas to be pushed out into residences.
- Graph #31 shows the clean water test from 2/17 and does not show any significant pressurization events occurring during the clean water test.
- Graph #32 shows the clean water tests from 3/2 and does not show any significant pressurization events occurring during the clean water test.

Graphs #33-35
Show recorded pressures observed in MH-7 compared to the flow being monitored at the inflow of MH-7.

- Graph #33 does not show substantial pressurization events during the background and clean water testing performed to date.
- Graph #34 shows the clean water test of 2/17 and does not show any significant pressurization events.
- Graph #35 shows the clean water tests of 3/2 and does not show any significant pressurization events. This graph is reproduced below as Figure 1; it shows the insignificant pressures observed during the clean water flow testing. This manhole also is the one with the highest overall flows since it is the furthest downstream point in the test area.

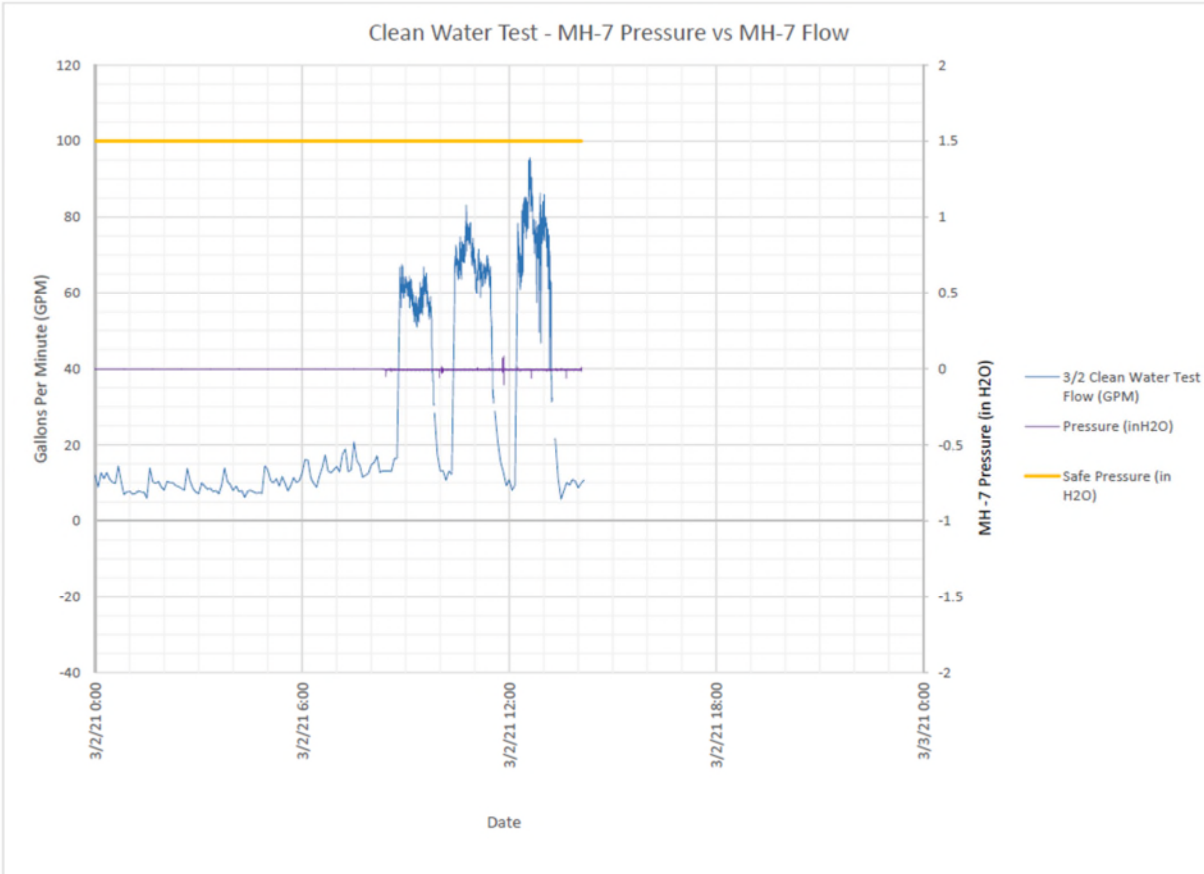
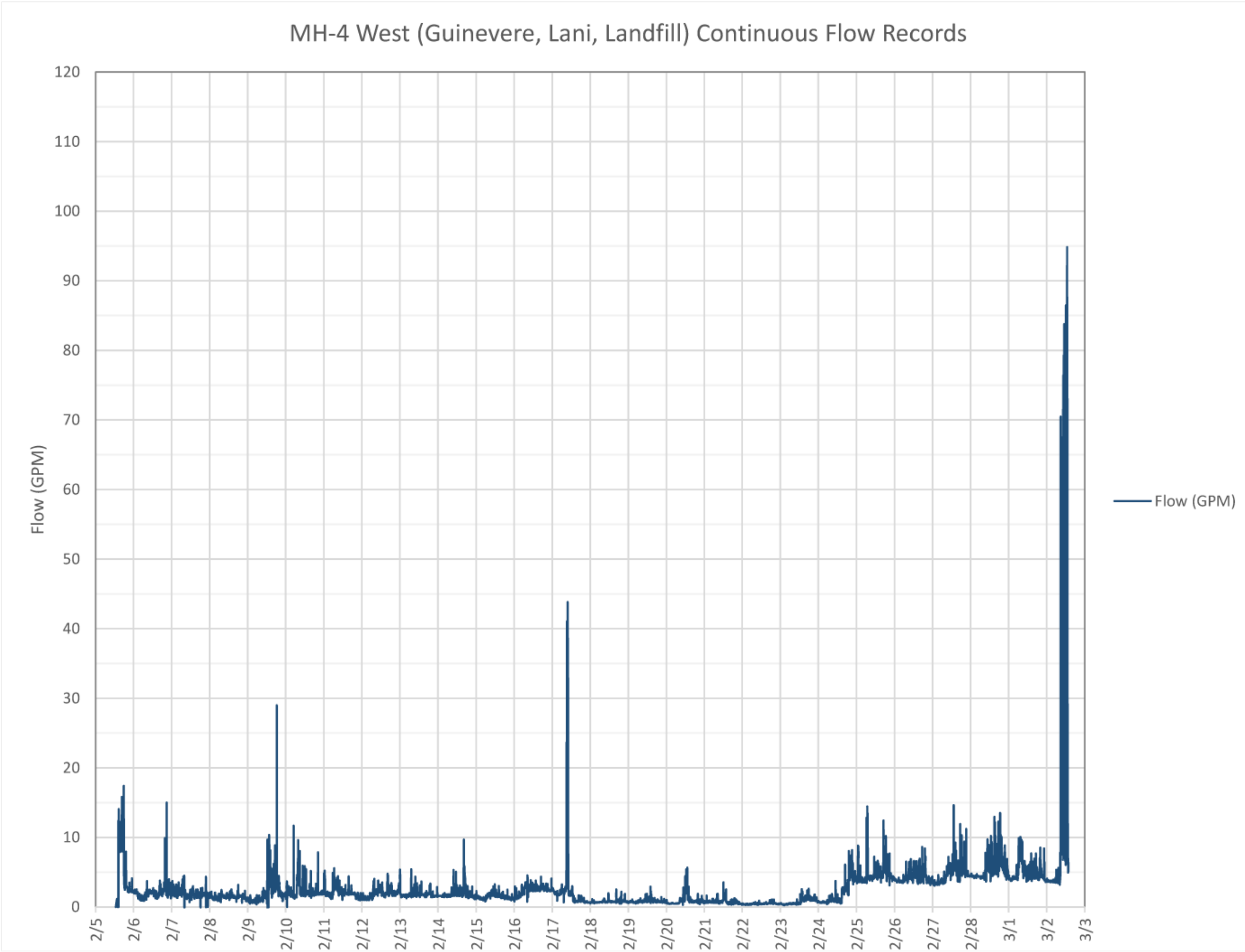


Figure 1. Clean Water Test – MH-7 Pressure and Flow

ATTACHMENT F

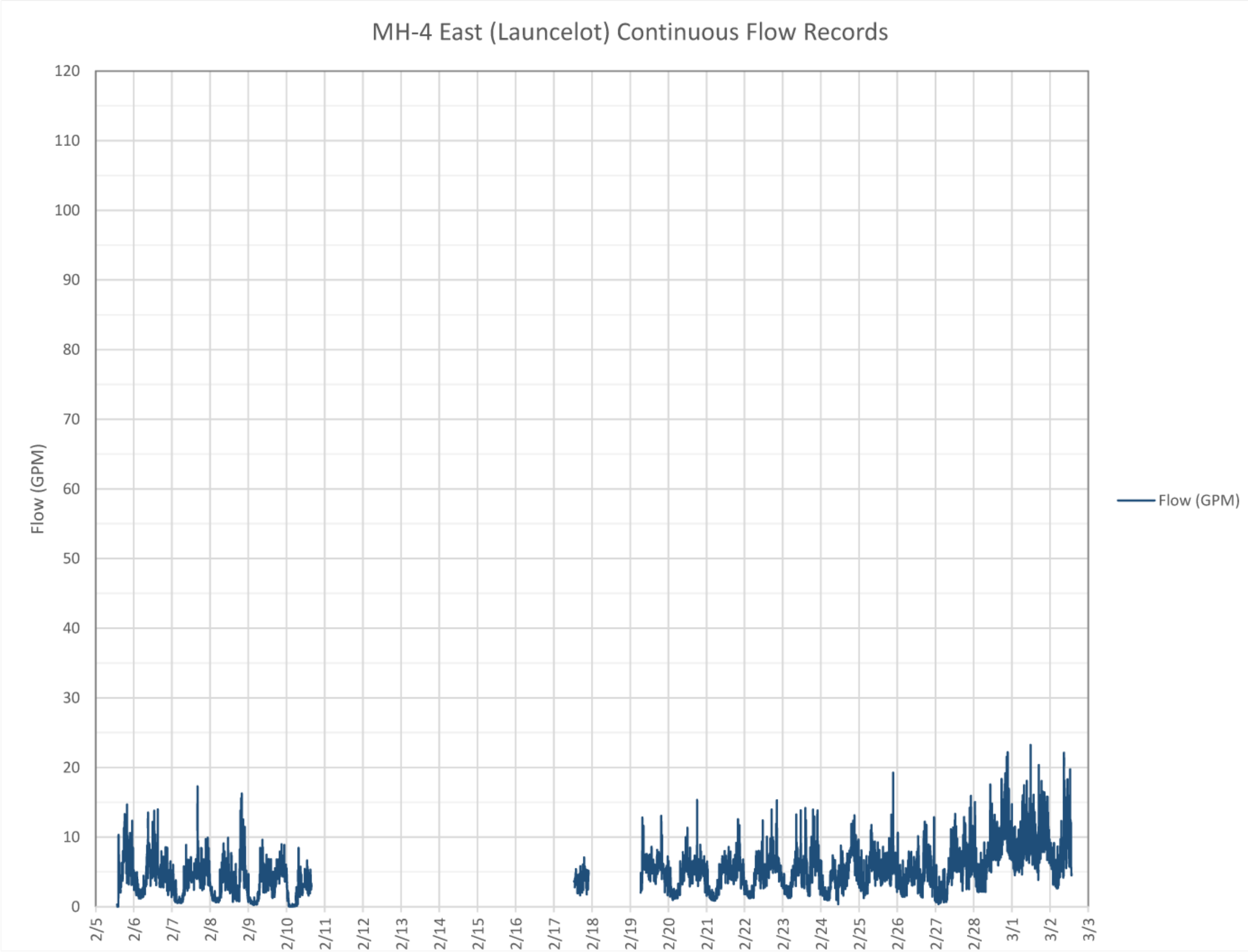
Data Graphs

GRAPH #1



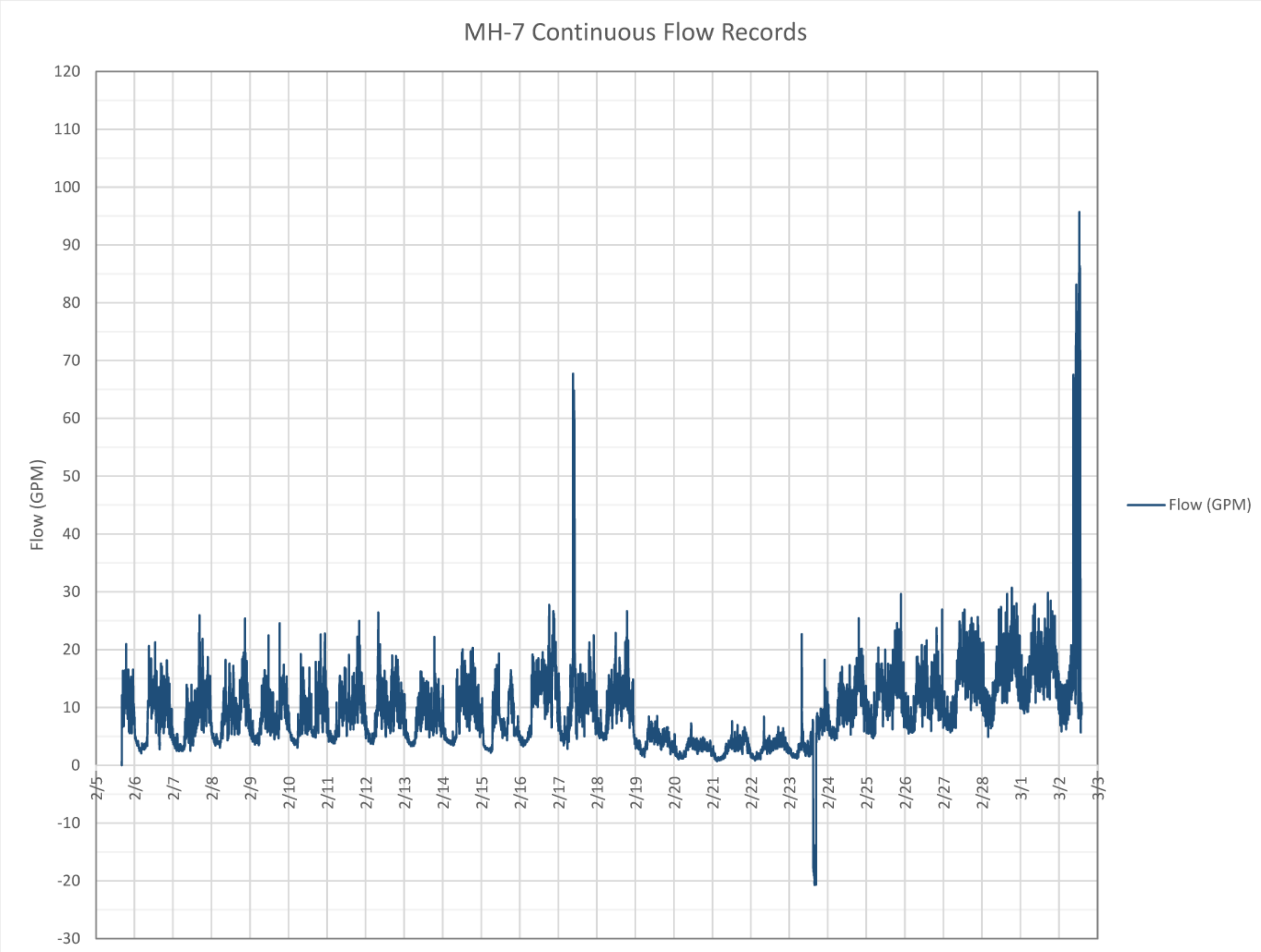
MH-4 West (Guinevere, Lani, Landfill) Continuous Flow Records
Flow (GPM)
0
10
20
30
40
50
60
70
80
90
100
110
120
2/5
2/6
2/7
2/8
2/9
2/10
2/11
2/12
2/13
2/14
2/15
2/16
2/17
2/18
2/19
2/20
2/21
2/22
2/23
2/24
2/25
2/26
2/27
2/28
3/1
3/2
3/3
Flow (GPM)

GRAPH #2

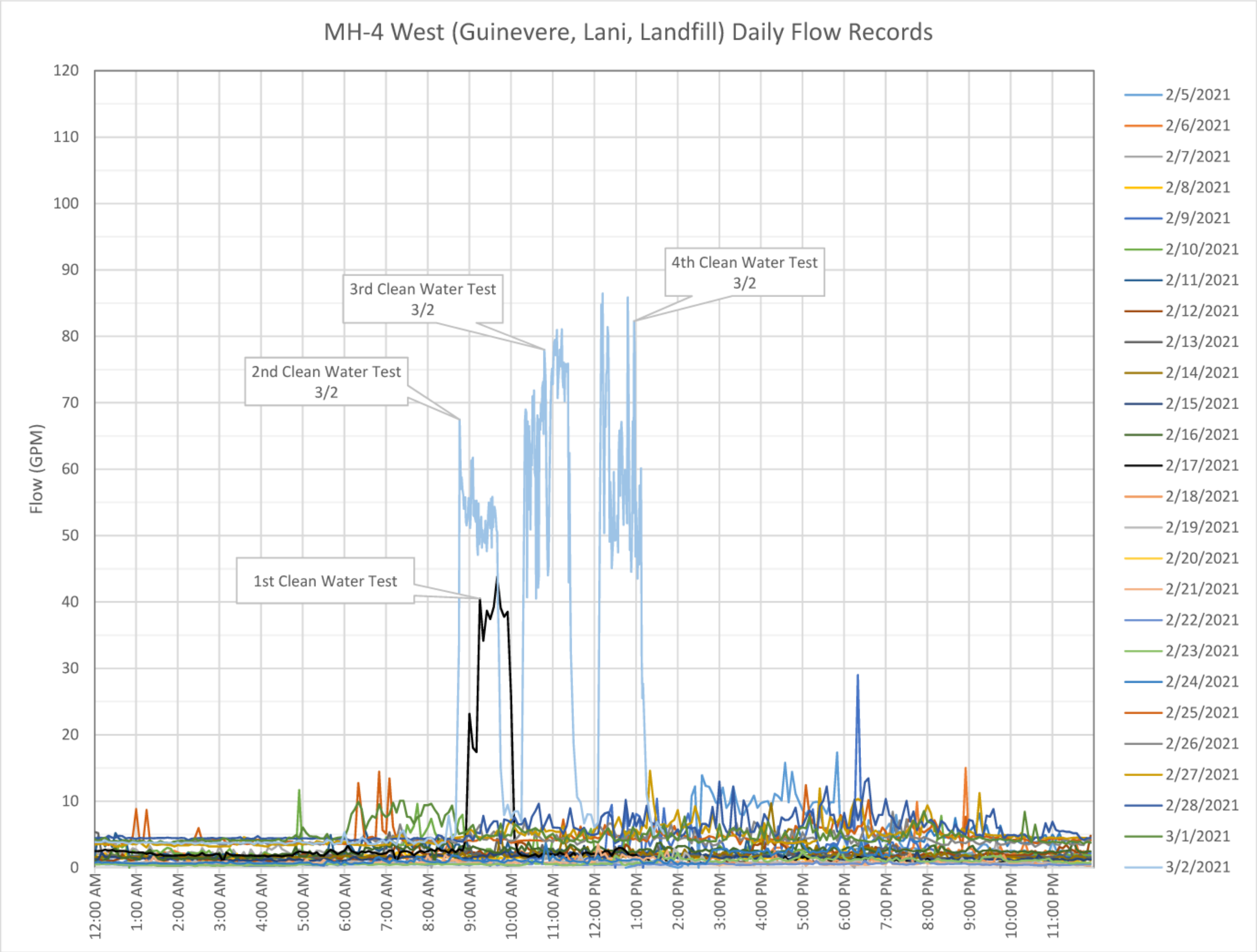


MH-4 East (Launcelot) Continuous Flow Records
Flow (GPM)
120
110
100
90
80
70
60
50
40
30
20
10
0
2/5
2/6
2/7
2/8
2/9
2/10
2/11
2/12
2/13
2/14
2/15
2/16
2/17
2/18
2/19
2/20
2/21
2/22
2/23
2/24
2/25
2/26
2/27
2/28
3/1
3/2
3/3
Flow (GPM)

GRAPH #3

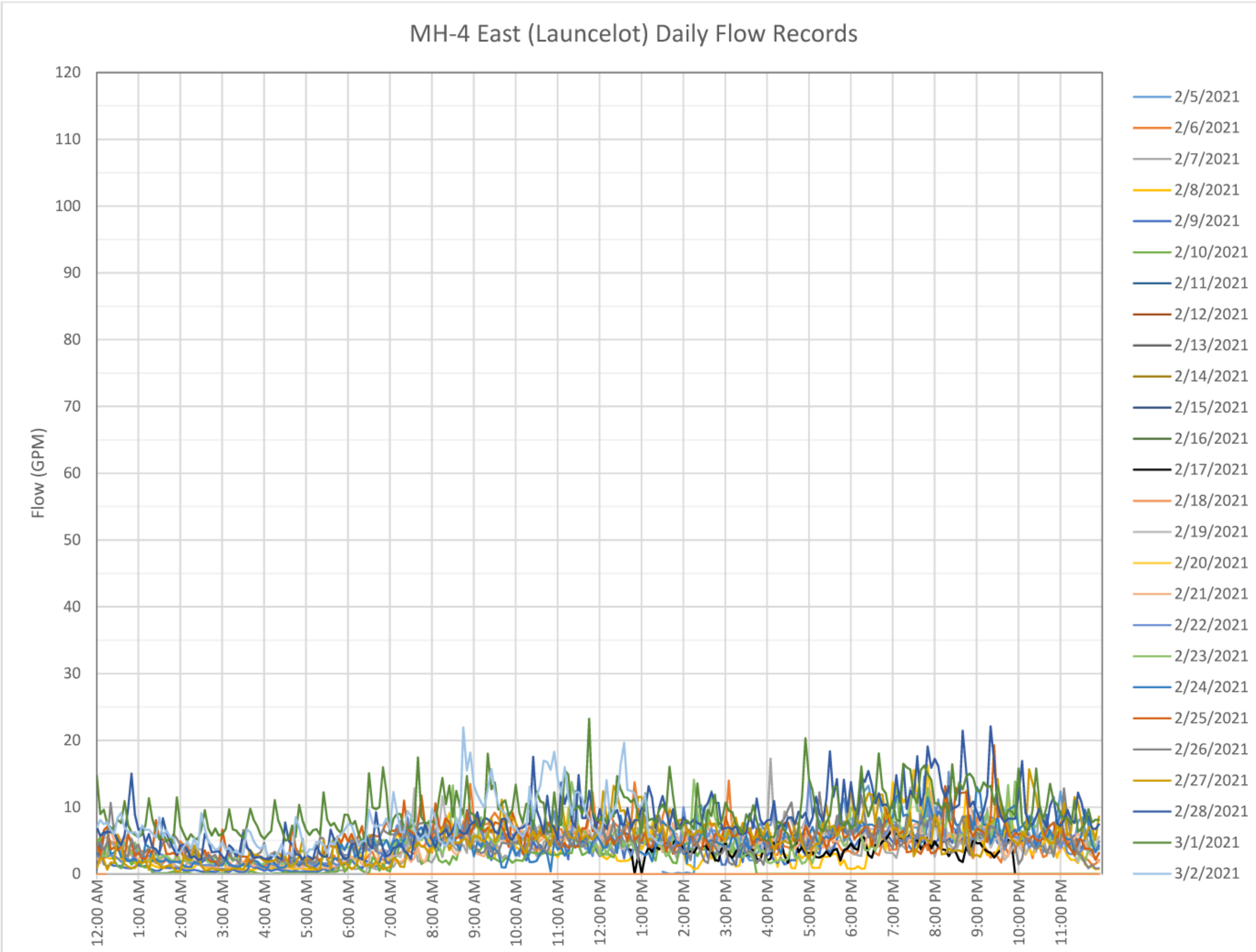

MH-7 Continuous Flow Records
Flow (GPM)
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
2/5
2/6
2/7
2/8
2/9
2/10
2/11
2/12
2/13
2/14
2/15
2/16
2/17
2/18
2/19
2/20
2/21
2/22
2/23
2/24
2/25
2/26
2/27
2/28
3/1
3/2
3/3
Flow (GPM)

GRAPH #4



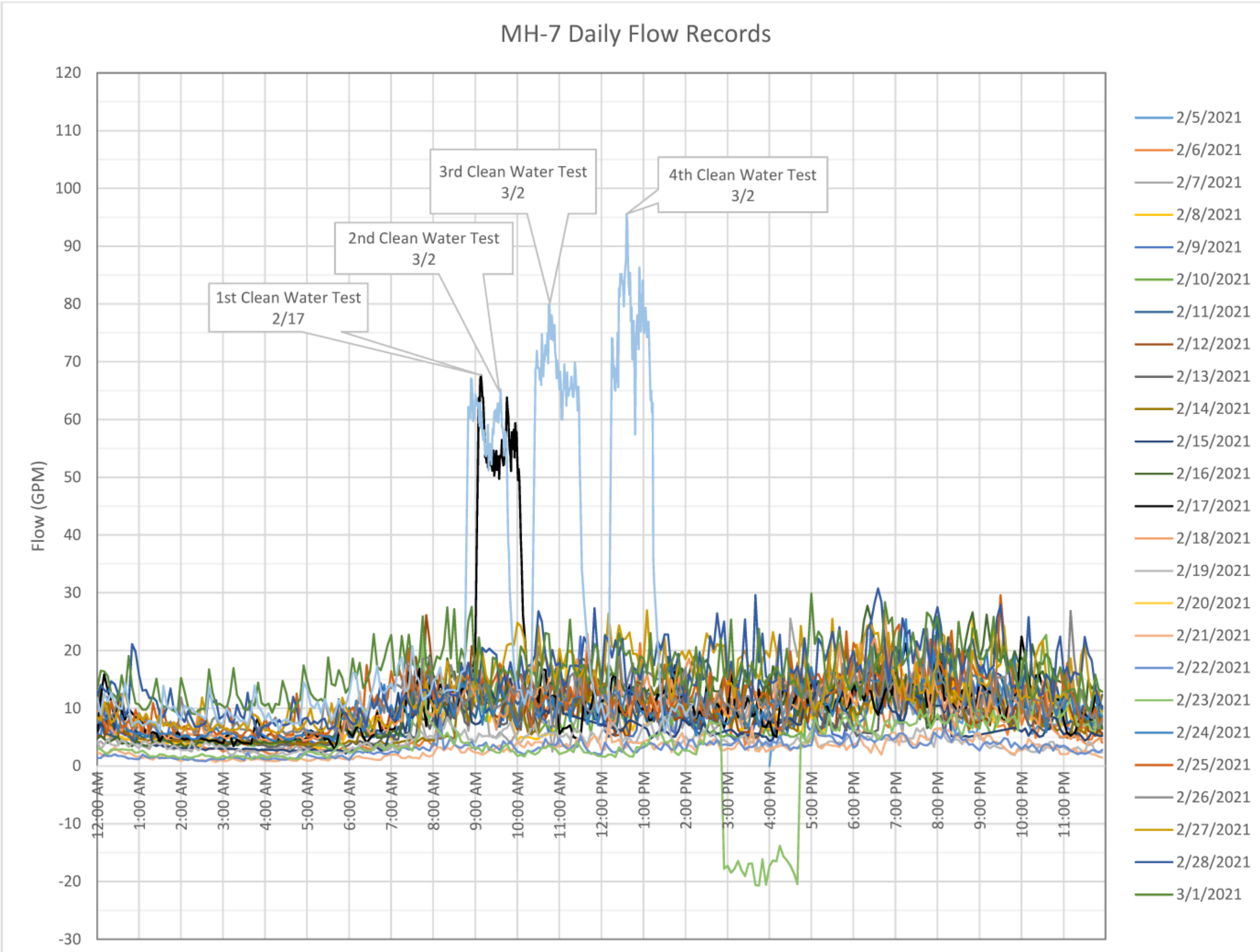
MH-4 West (Guinevere, Lani, Landfill) Daily Flow Records
Flow (GPM)
120
110
100
90
80
70
60
50
40
30
20
10
0
12:00 AM
1:00 AM
2:00 AM
3:00 AM
4:00 AM
5:00 AM
6:00 AM
7:00 AM
8:00 AM
9:00 AM
10:00 AM
11:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
6:00 PM
7:00 PM
8:00 PM
9:00 PM
10:00 PM
11:00 PM
1st Clean Water Test
2nd Clean Water Test 3/2
3rd Clean Water Test 3/2
4th Clean Water Test 3/2
2/5/2021
2/6/2021
2/7/2021
2/8/2021
2/9/2021
2/10/2021
2/11/2021
2/12/2021
2/13/2021
2/14/2021
2/15/2021
2/16/2021
2/17/2021
2/18/2021
2/19/2021
2/20/2021
2/21/2021
2/22/2021
2/23/2021
2/24/2021
2/25/2021
2/26/2021
2/27/2021
2/28/2021
3/1/2021
3/2/2021

GRAPH #5



MH-4 East (Launcelot) Daily Flow Records
Flow (GPM)
120
110
100
90
80
70
60
50
40
30
20
10
0
12:00 AM
1:00 AM
2:00 AM
3:00 AM
4:00 AM
5:00 AM
6:00 AM
7:00 AM
8:00 AM
9:00 AM
10:00 AM
11:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
6:00 PM
7:00 PM
8:00 PM
9:00 PM
10:00 PM
11:00 PM
2/5/2021
2/6/2021
2/7/2021
2/8/2021
2/9/2021
2/10/2021
2/11/2021
2/12/2021
2/13/2021
2/14/2021
2/15/2021
2/16/2021
2/17/2021
2/18/2021
2/19/2021
2/20/2021
2/21/2021
2/22/2021
2/23/2021
2/24/2021
2/25/2021
2/26/2021
2/27/2021
2/28/2021
3/1/2021
3/2/2021

GRAPH #6


MH-7 Daily Flow Records
Flow (GPM)
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
12:00 AM
1:00 AM
2:00 AM
3:00 AM
4:00 AM
5:00 AM
6:00 AM
7:00 AM
8:00 AM
9:00 AM
10:00 AM
11:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
6:00 PM
7:00 PM
8:00 PM
9:00 PM
10:00 PM
11:00 PM
1st Clean Water Test 2/17
2nd Clean Water Test 3/2
3rd Clean Water Test 3/2
4th Clean Water Test 3/2
2/5/2021
2/6/2021
2/7/2021
2/8/2021
2/9/2021
2/10/2021
2/11/2021
2/12/2021
2/13/2021
2/14/2021
2/15/2021
2/16/2021
2/17/2021
2/18/2021
2/19/2021
2/20/2021
2/21/2021
2/22/2021
2/23/2021
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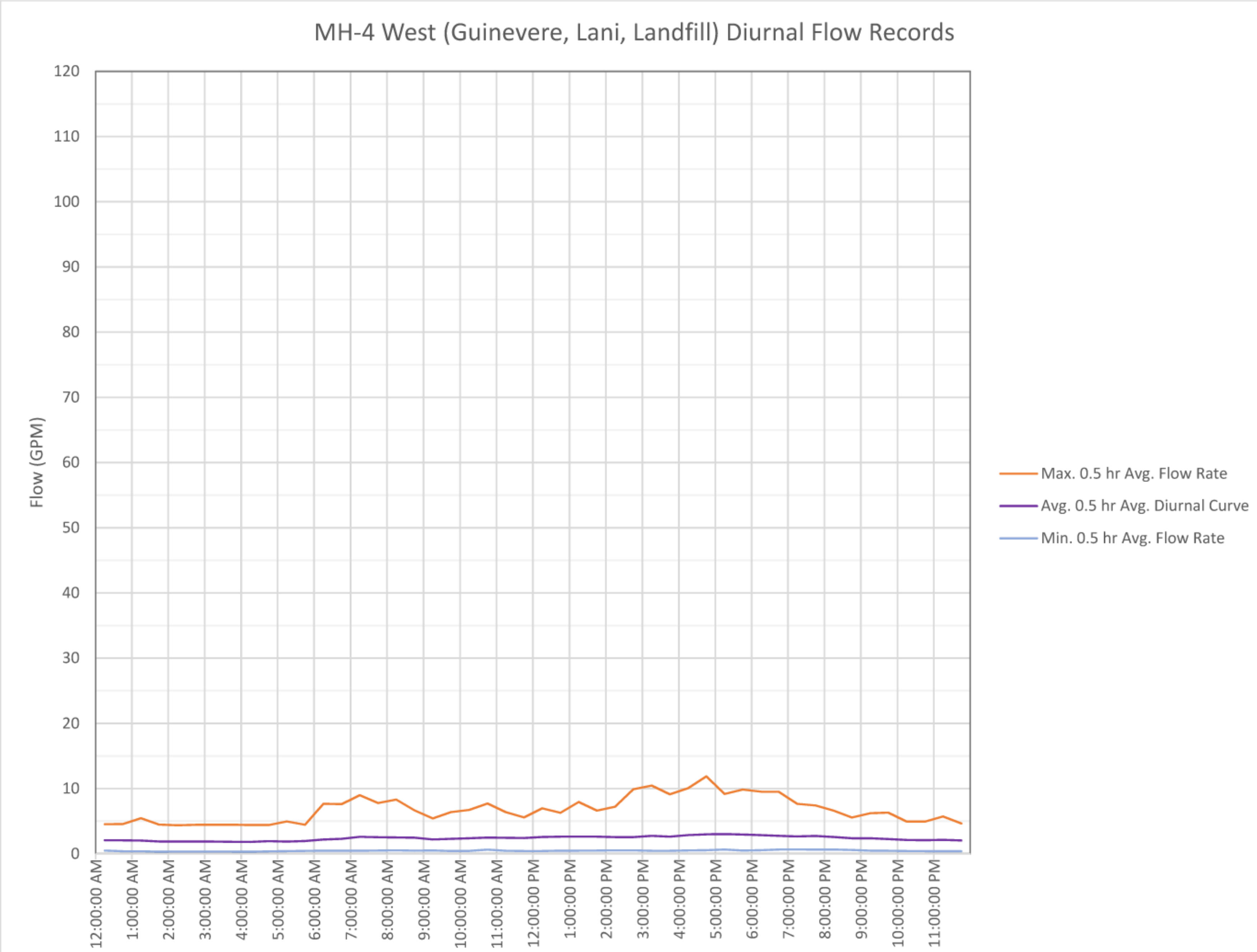
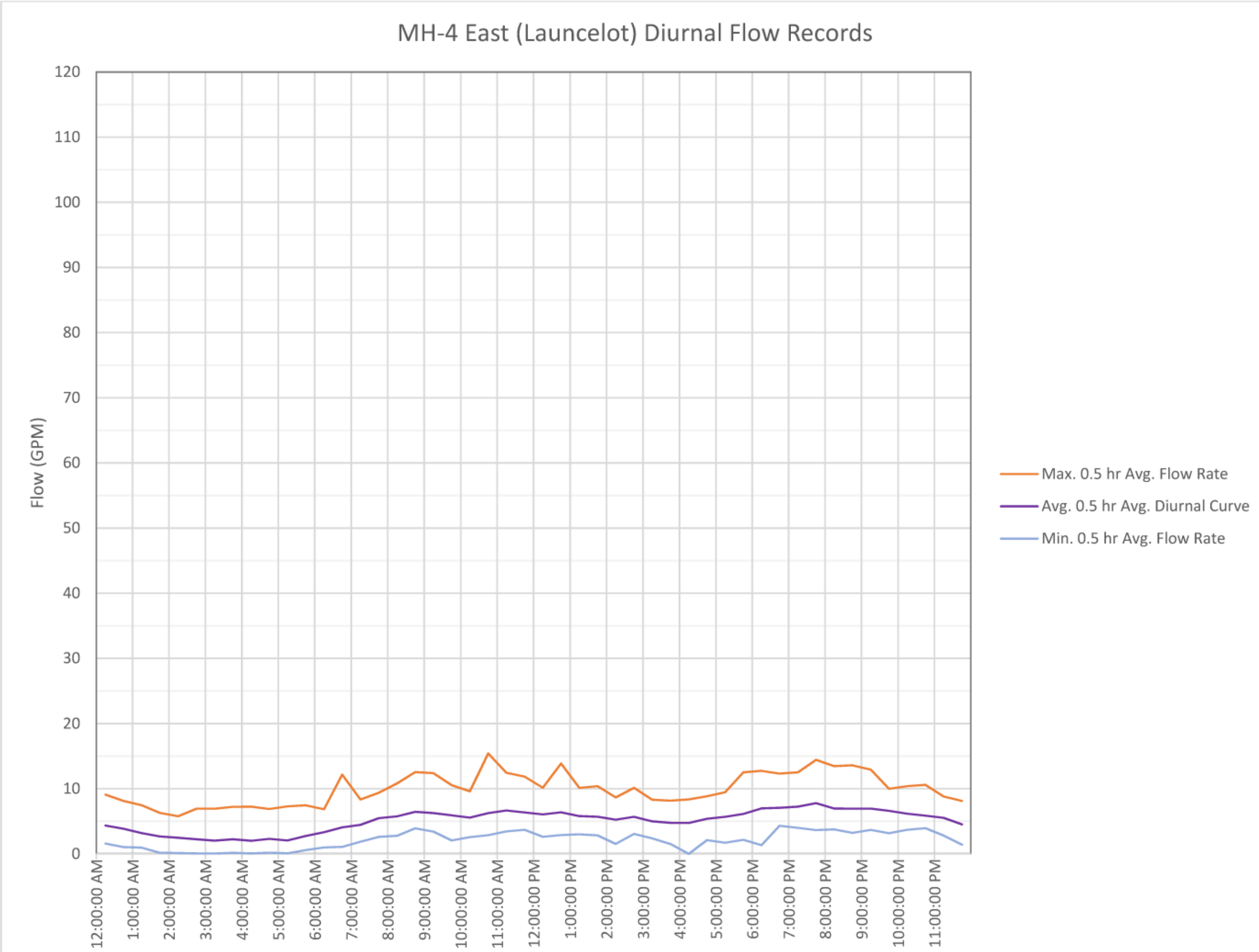
2/26/2021
2/27/2021
2/28/2021
3/1/2021

GRAPH #7



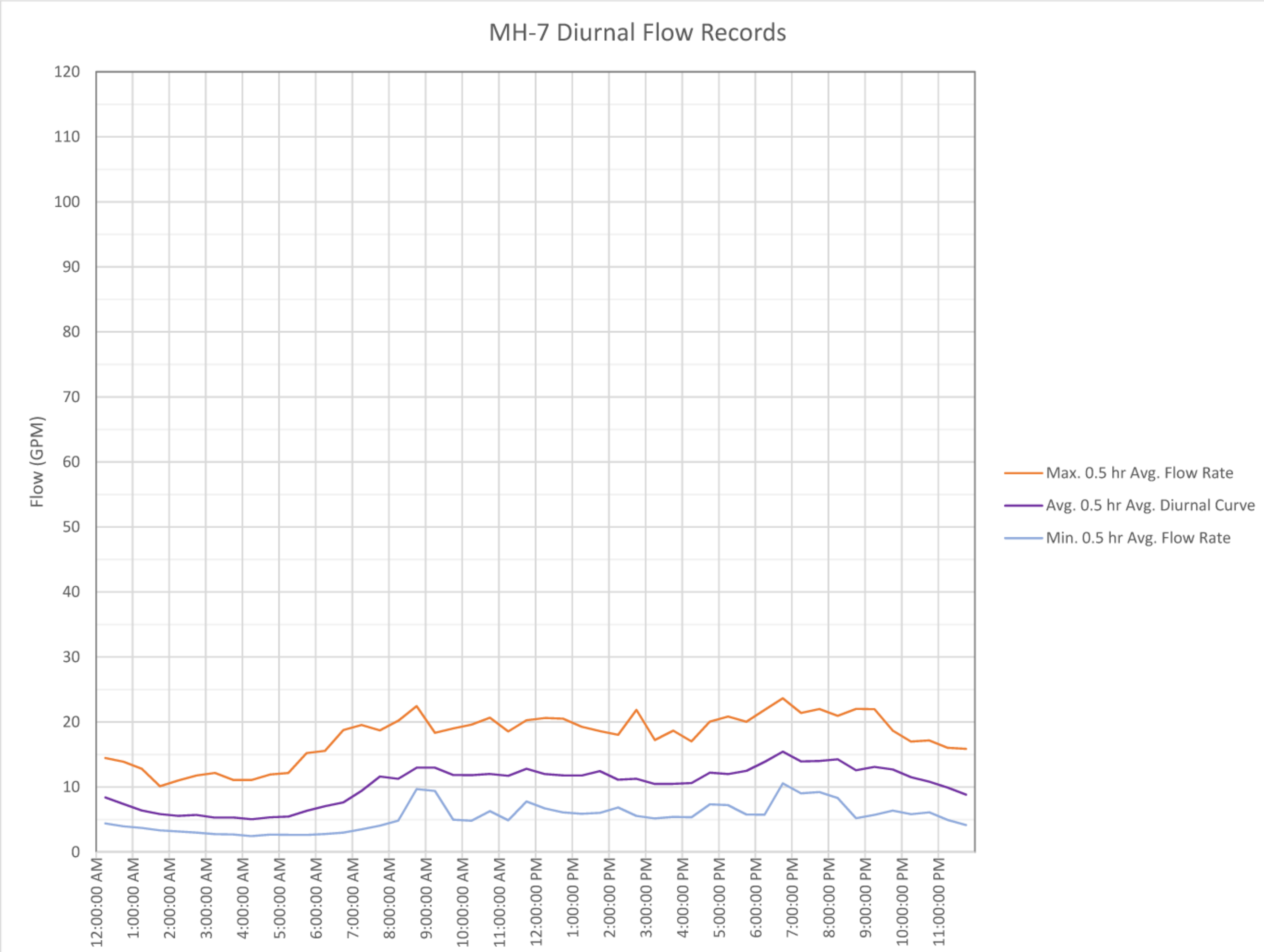
*Note the Maximum and Average Flows exclude the times during which the clean water testing was performed

GRAPH #8



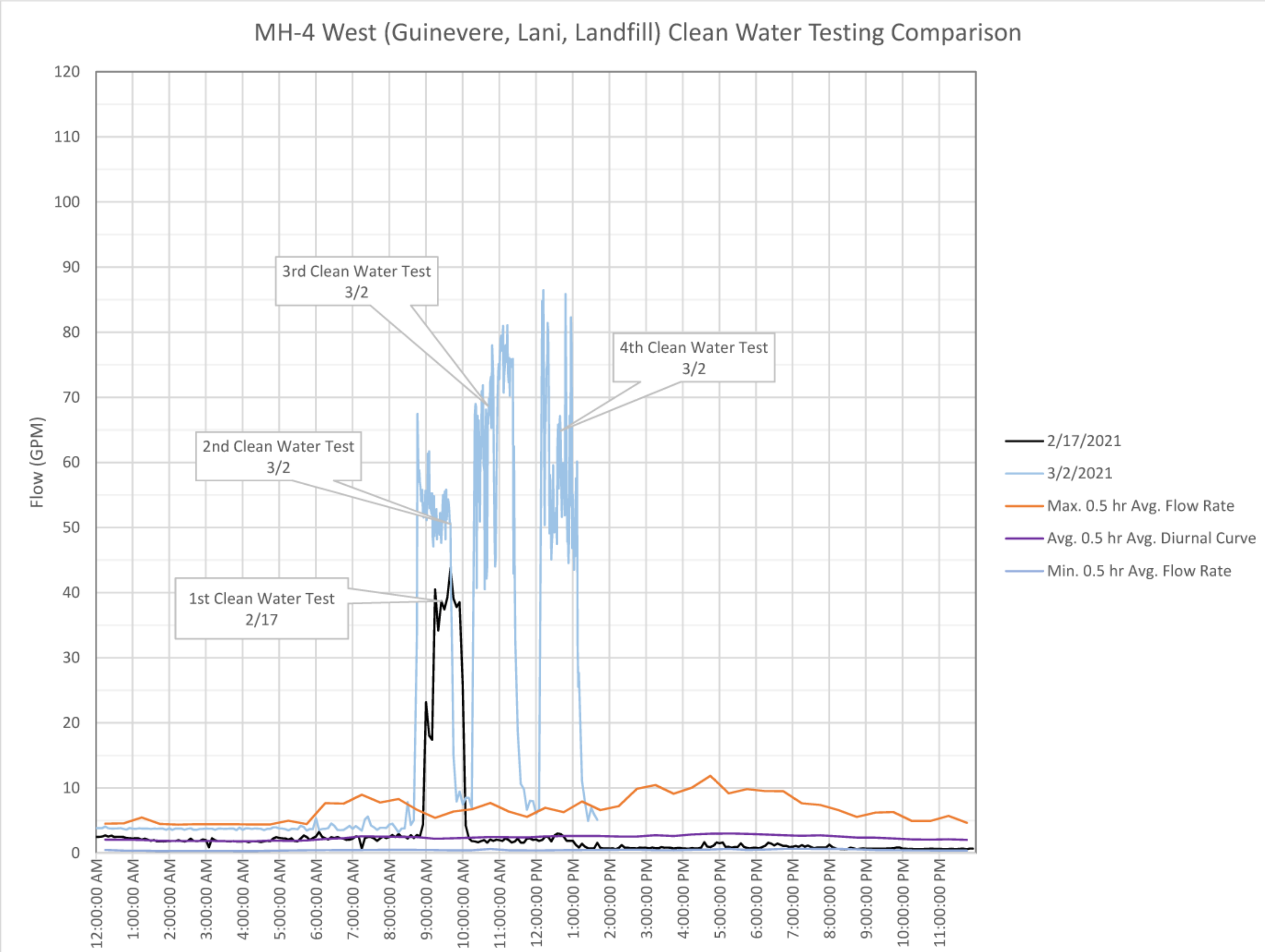
*Note the Maximum and Average Flows exclude the times during which the clean water testing was performed

GRAPH #9



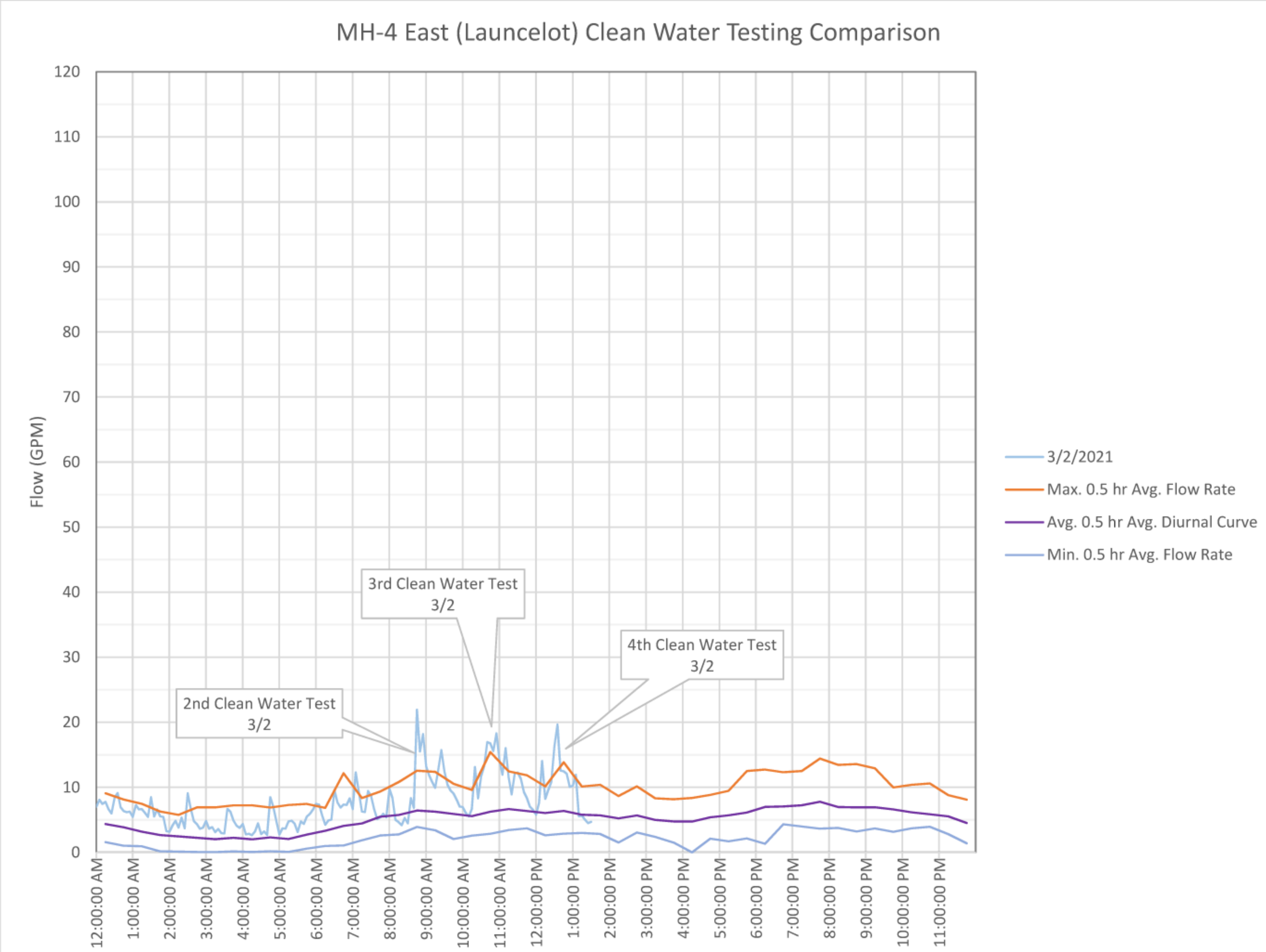
*Note the Maximum and Average Flows exclude the times during which the clean water testing was performed

GRAPH #10



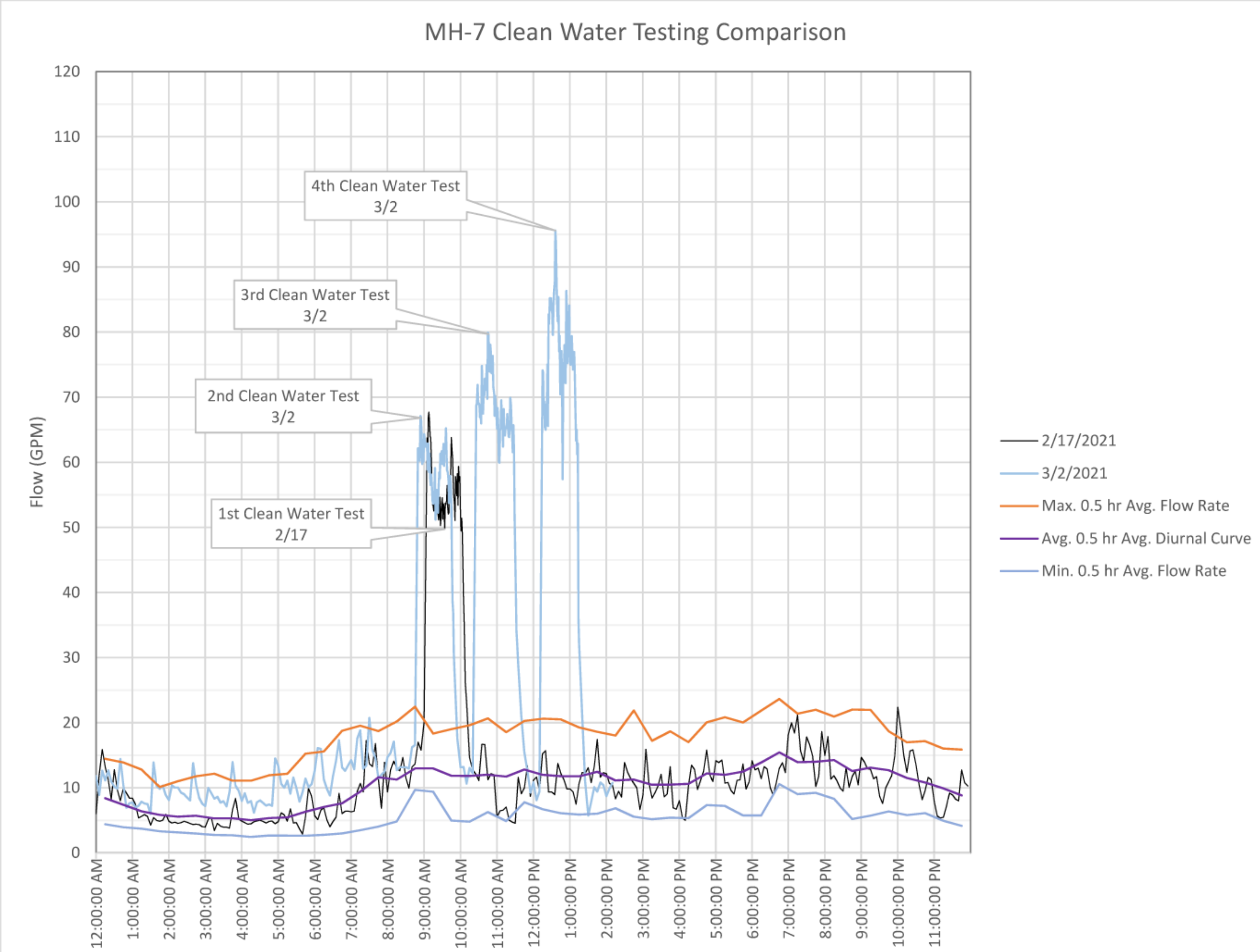
*Note the Maximum and Average Flows exclude the times during which the clean water testing was performed

GRAPH #11



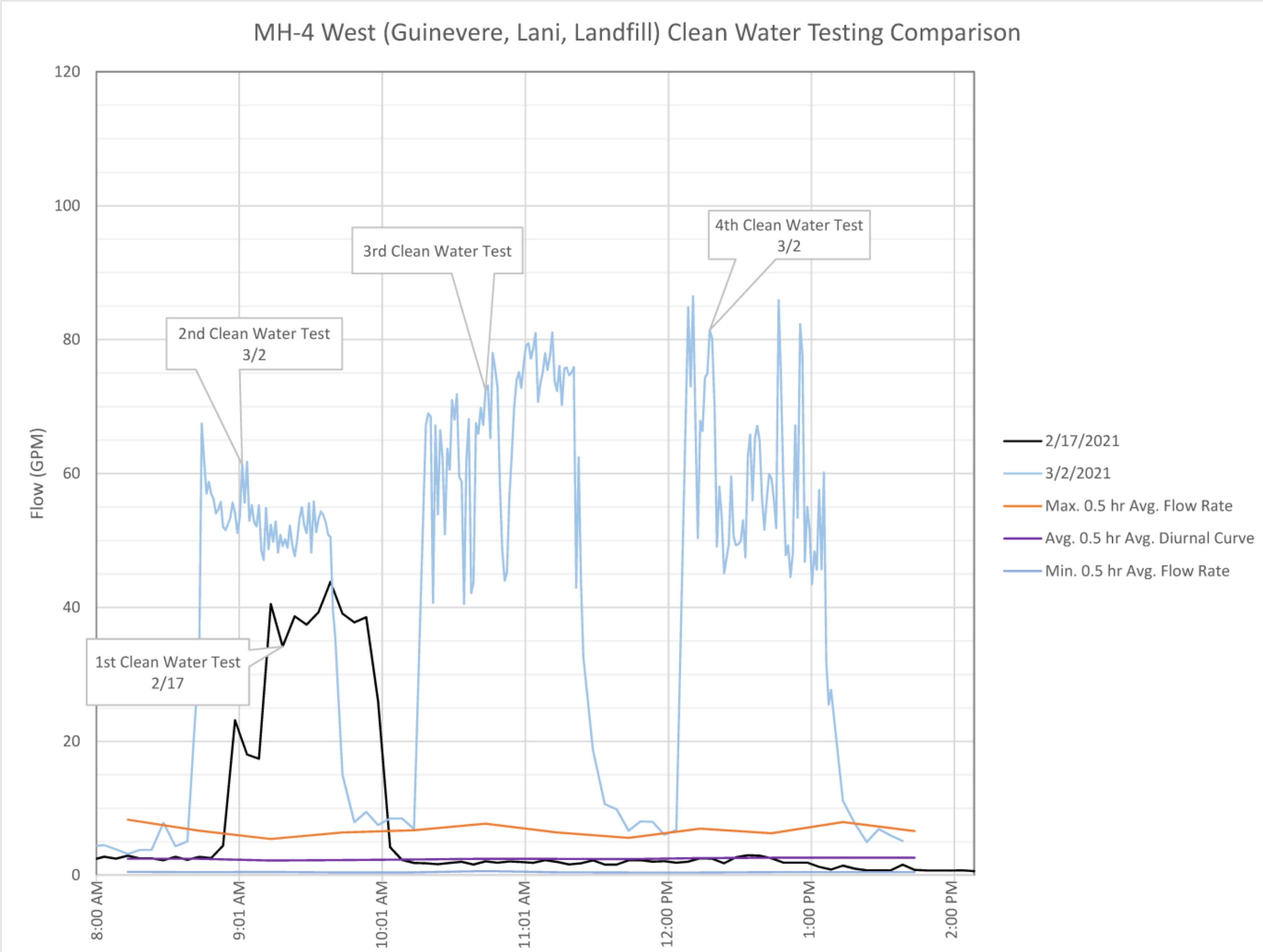
*Note the Maximum and Average Flows exclude the times during which the clean water testing was performed

GRAPH #12



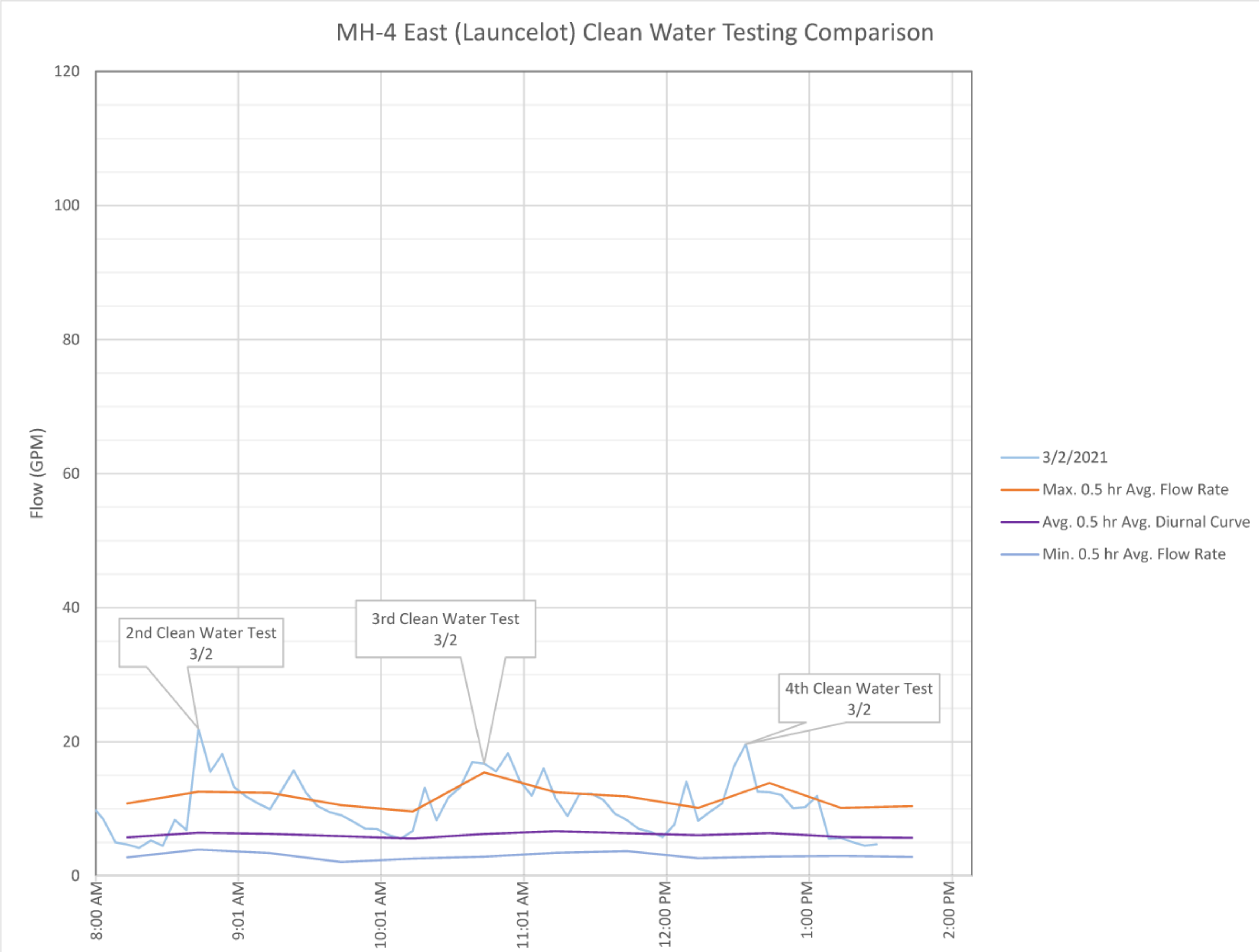
*Note the Maximum and Average Flows exclude the times during which the clean water testing was performed

GRAPH #13



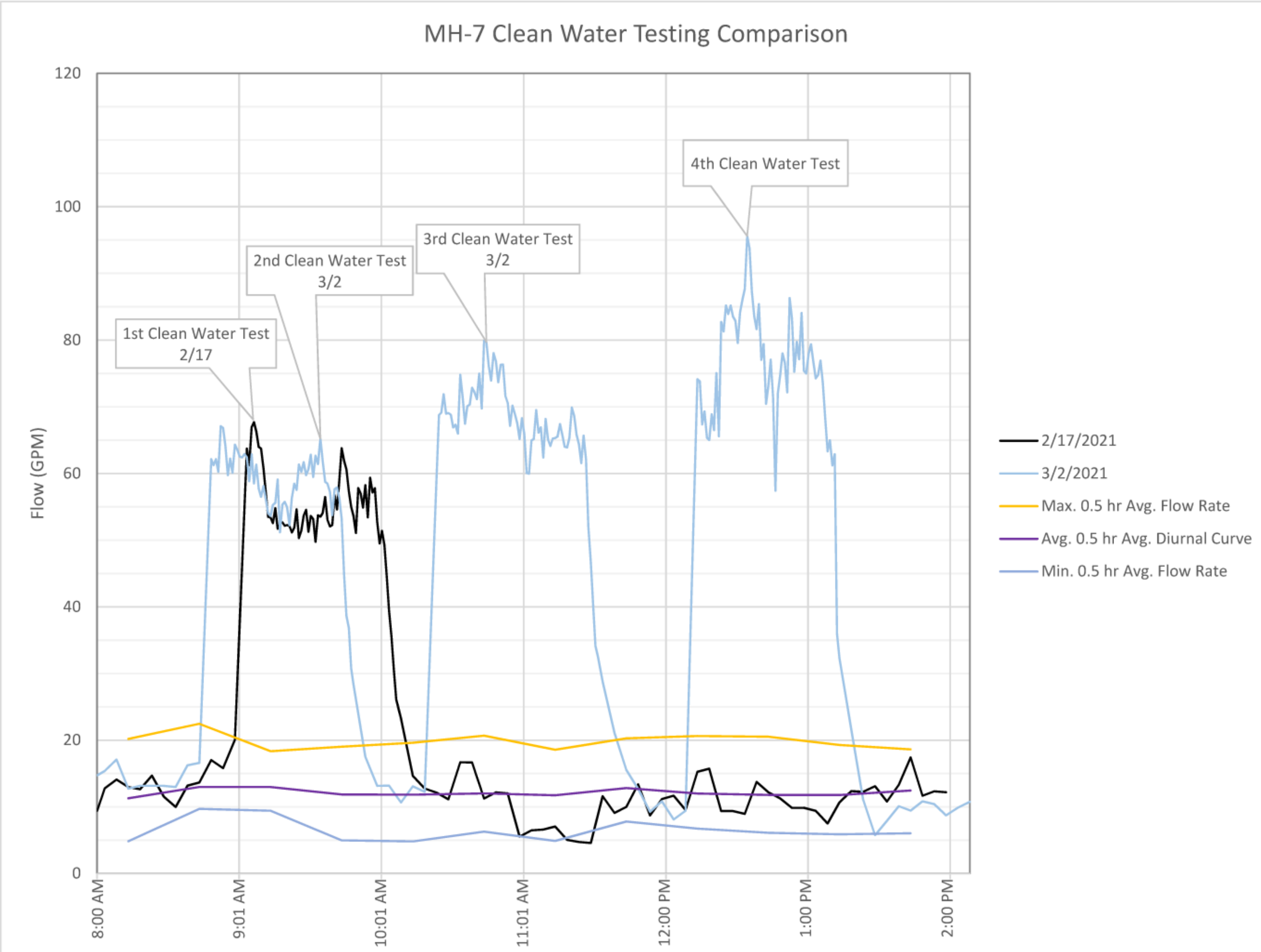
*Note the Maximum and Average Flows exclude the times during which the clean water testing was performed

GRAPH #14



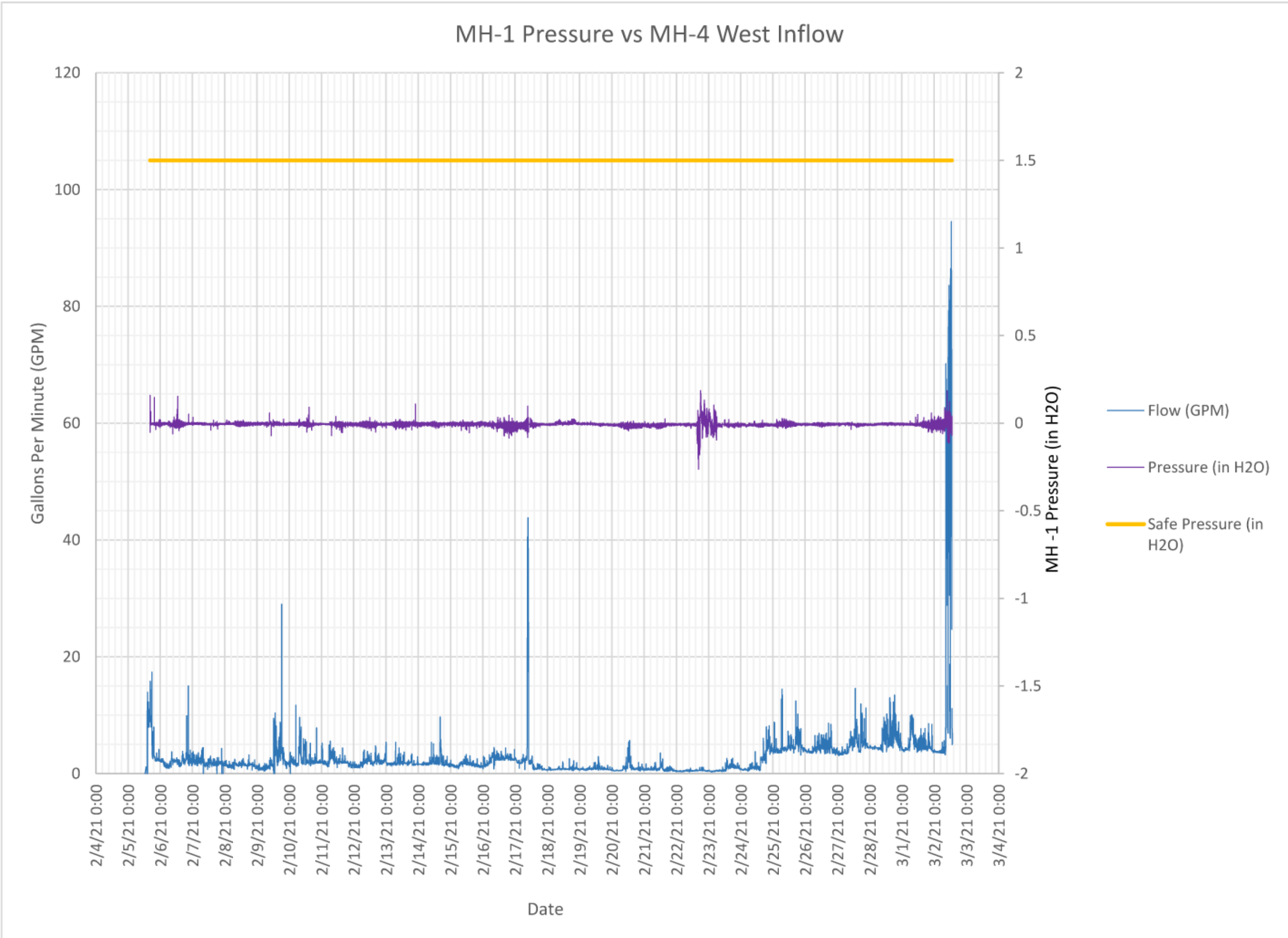
*Note the Maximum and Average Flows exclude the times during which the clean water testing was performed

GRAPH #15



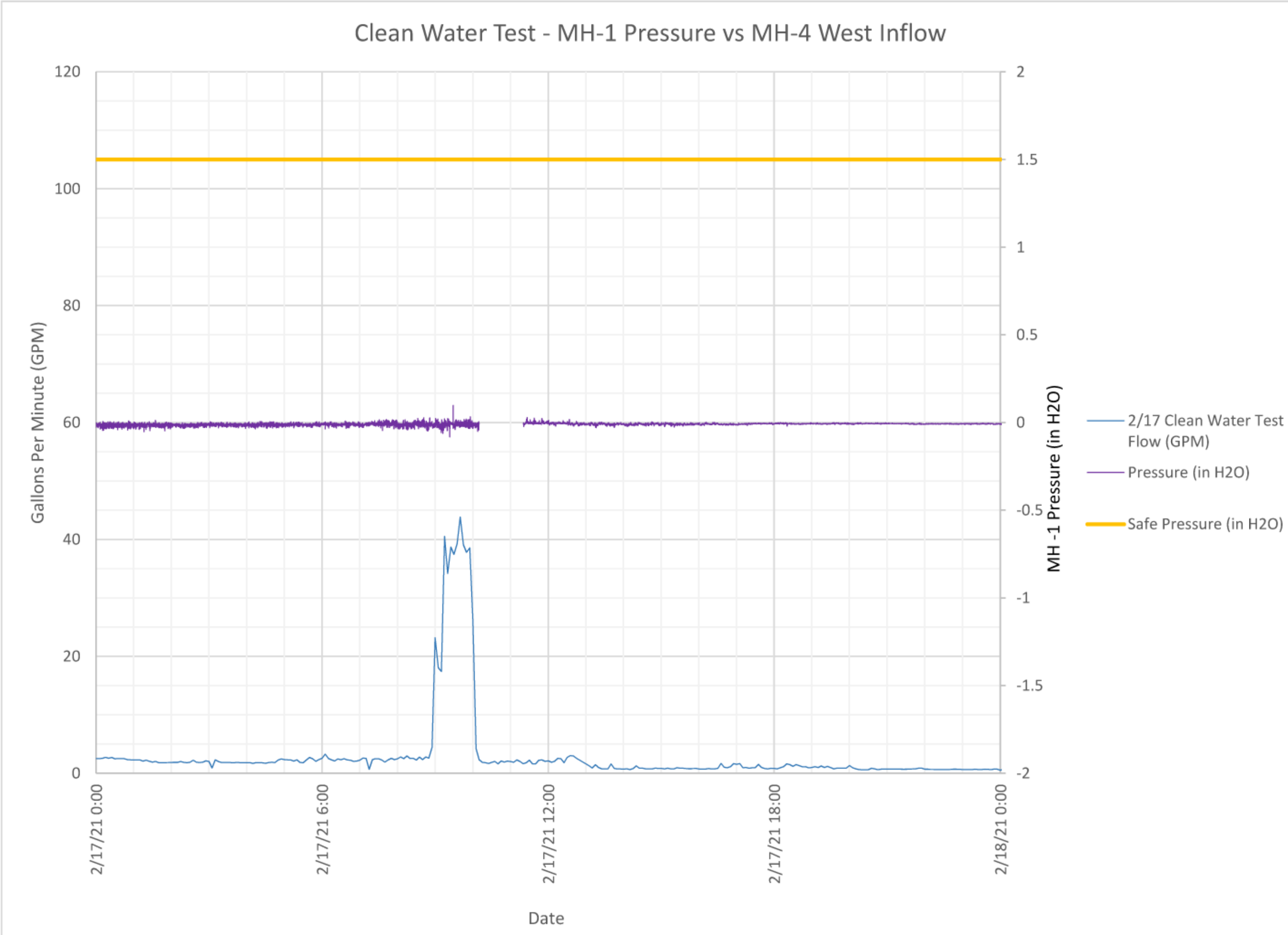
*Note the Maximum and Average Flows exclude the times during which the clean water testing was performed

GRAPH #16



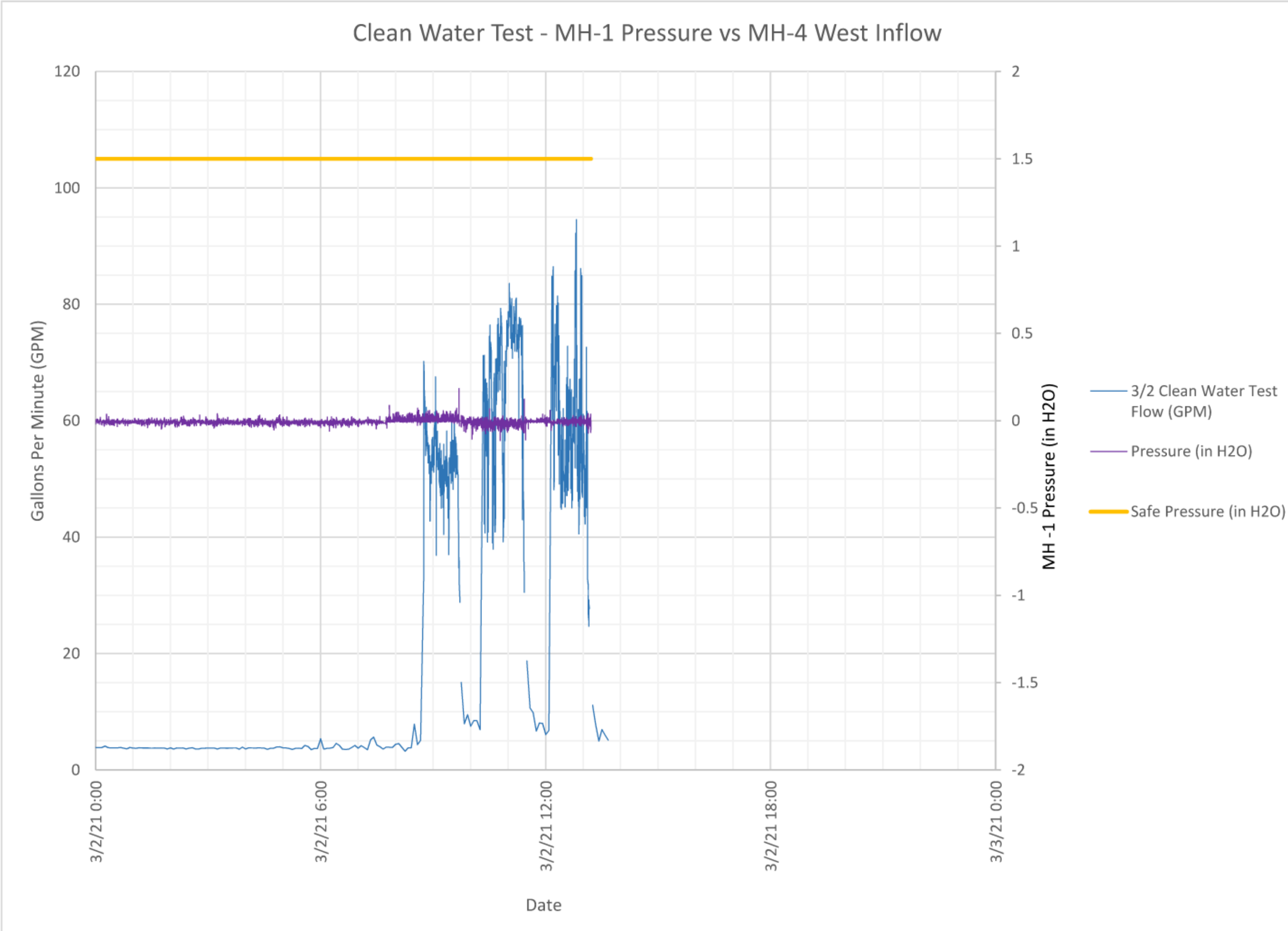
MH-1 Pressure vs MH-4 West Inflow
Gallons Per Minute (GPM)
MH -1 Pressure (in H2O)
Date
0
20
40
60
80
100
120
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2/4/21 0:00
2/5/21 0:00
2/6/21 0:00
2/7/21 0:00
2/8/21 0:00
2/9/21 0:00
2/10/21 0:00
2/11/21 0:00
2/12/21 0:00
2/13/21 0:00
2/14/21 0:00
2/15/21 0:00
2/16/21 0:00
2/17/21 0:00
2/18/21 0:00
2/19/21 0:00
2/20/21 0:00
2/21/21 0:00
2/22/21 0:00
2/23/21 0:00
2/24/21 0:00
2/25/21 0:00
2/26/21 0:00
2/27/21 0:00
2/28/21 0:00
3/1/21 0:00
3/2/21 0:00
3/3/21 0:00
3/4/21 0:00
Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #17



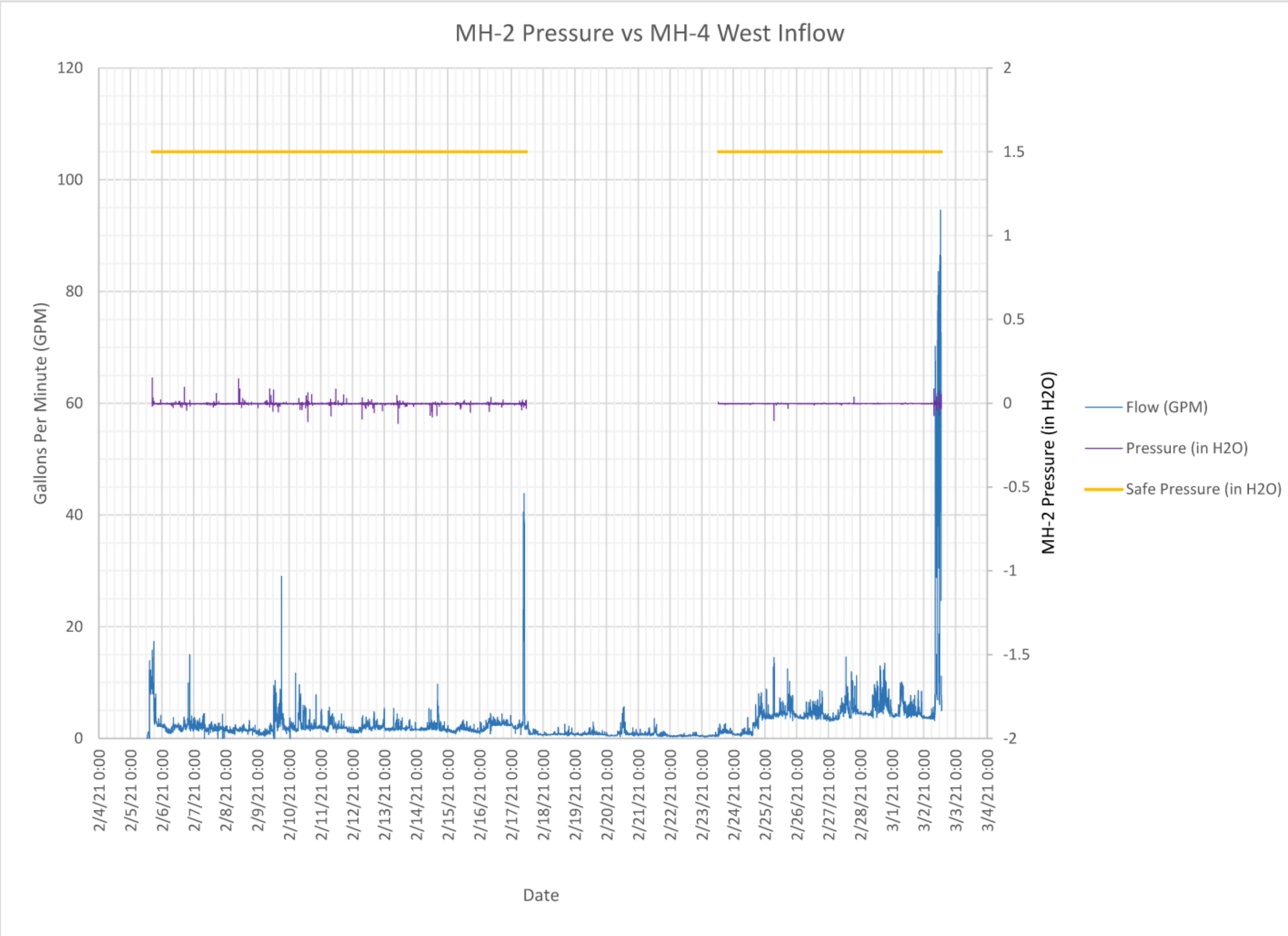
Clean Water Test - MH-1 Pressure vs MH-4 West Inflow
Gallons Per Minute (GPM)
MH -1 Pressure (in H2O)
120
100
80
60
40
20
0
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
2/17/21 0:00
2/17/21 6:00
2/17/21 12:00
2/17/21 18:00
2/18/21 0:00
Date
2/17 Clean Water Test Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #18

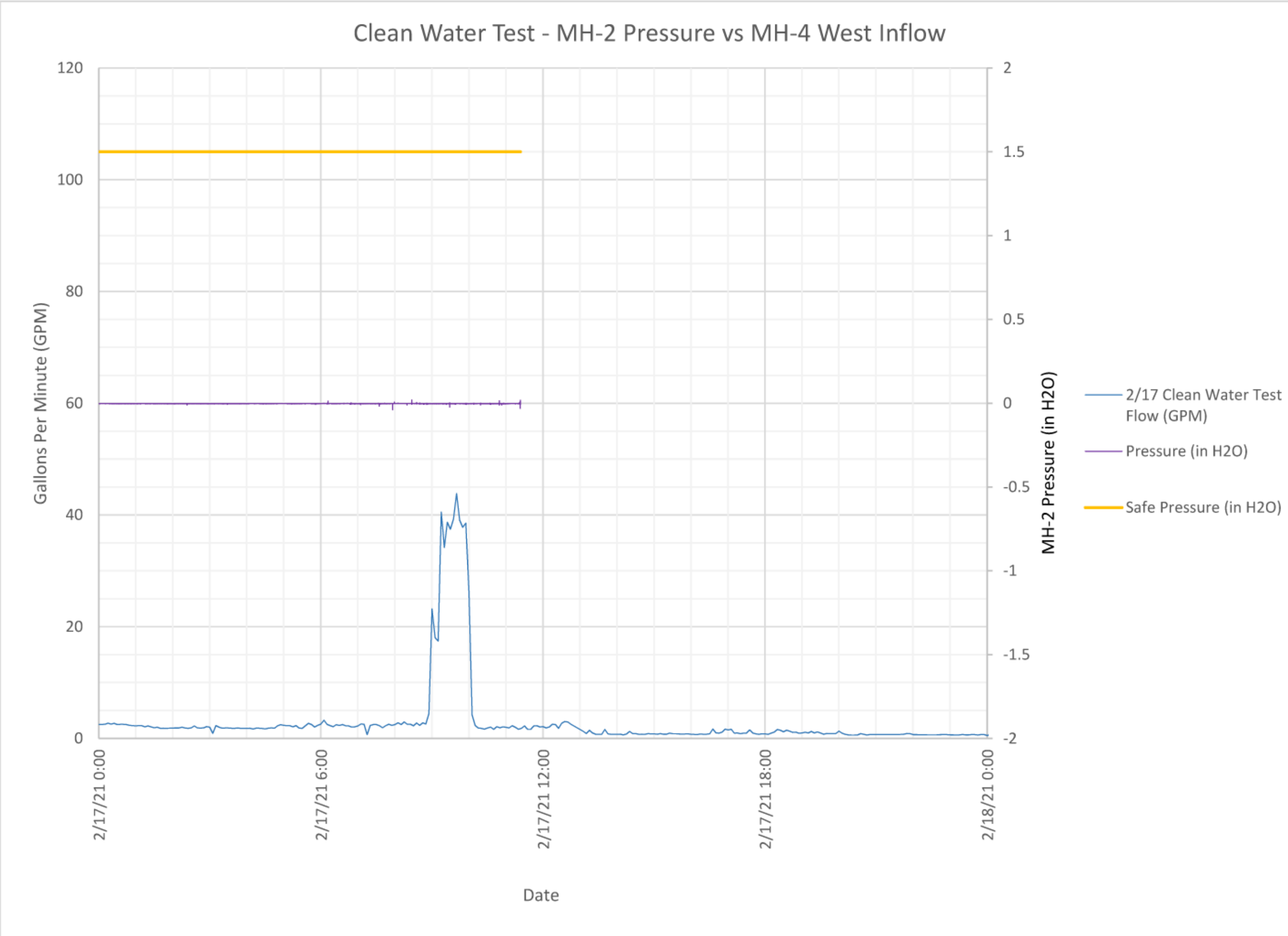


Clean Water Test - MH-1 Pressure vs MH-4 West Inflow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
MH -1 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
3/2/21 0:00
3/2/21 6:00
3/2/21 12:00
3/2/21 18:00
3/3/21 0:00
Date
3/2 Clean Water Test Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #19

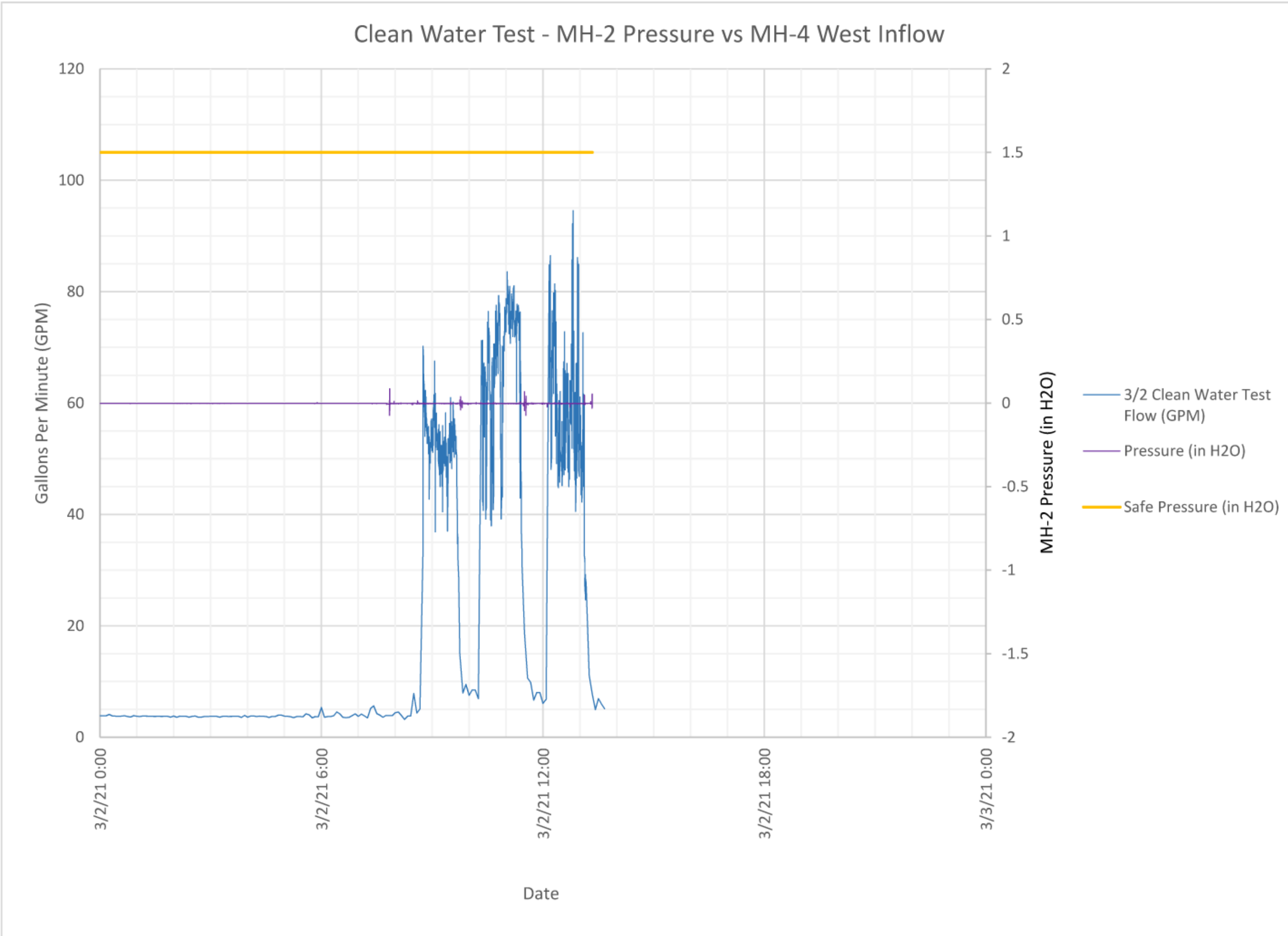

MH-2 Pressure vs MH-4 West Inflow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
MH-2 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
2/4/21 0:00
2/5/21 0:00
2/6/21 0:00
2/7/21 0:00
2/8/21 0:00
2/9/21 0:00
2/10/21 0:00
2/11/21 0:00
2/12/21 0:00
2/13/21 0:00
2/14/21 0:00
2/15/21 0:00
2/16/21 0:00
2/17/21 0:00
2/18/21 0:00
2/19/21 0:00
2/20/21 0:00
2/21/21 0:00
2/22/21 0:00
2/23/21 0:00
2/24/21 0:00
2/25/21 0:00
2/26/21 0:00
2/27/21 0:00
2/28/21 0:00
3/1/21 0:00
3/2/21 0:00
3/3/21 0:00
3/4/21 0:00
Date
Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #20



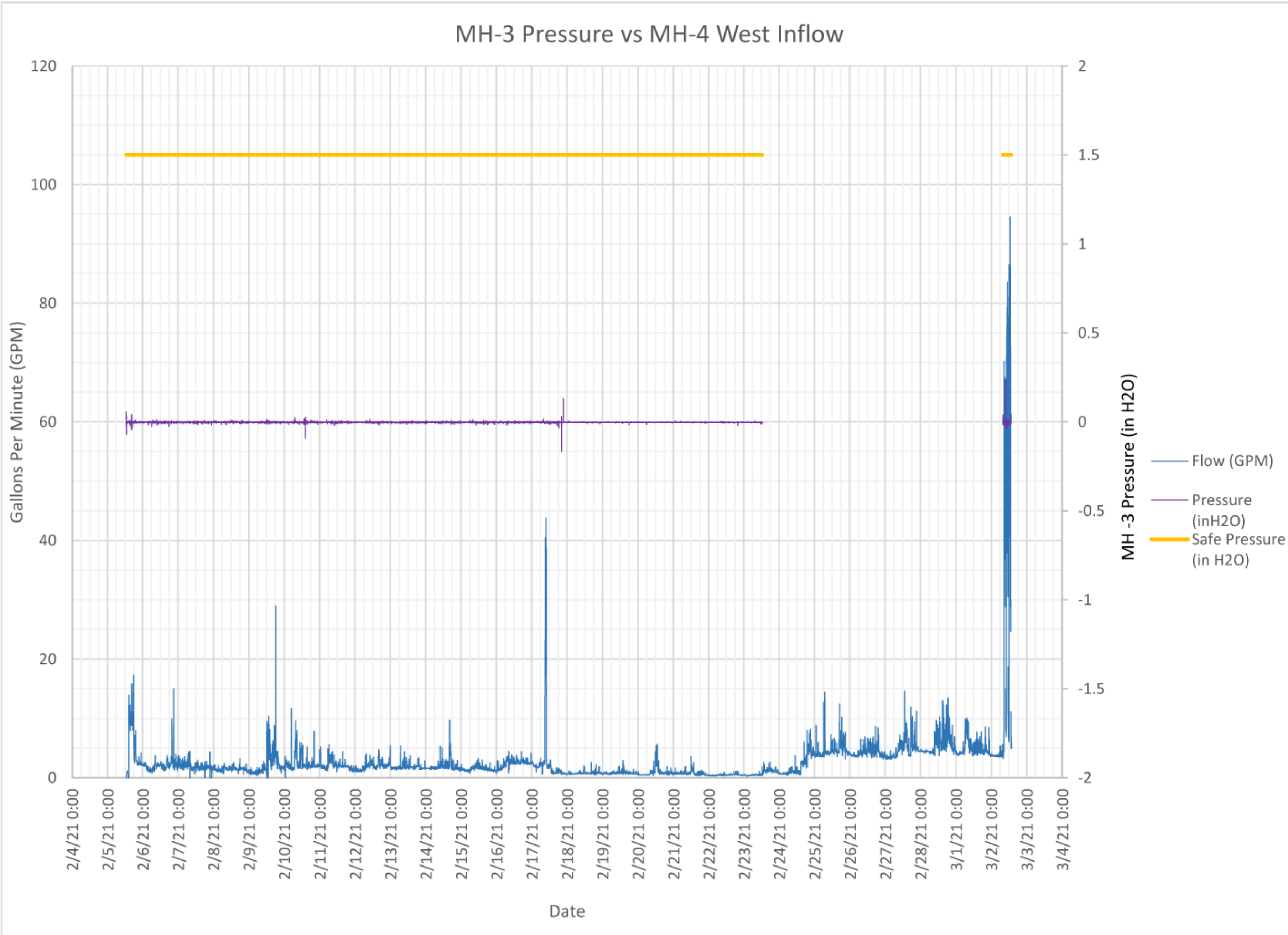
Clean Water Test - MH-2 Pressure vs MH-4 West Inflow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
MH-2 Pressure (in H2O)
2/17/21 0:00
2/17/21 6:00
2/17/21 12:00
2/17/21 18:00
2/18/21 0:00
Date
2/17 Clean Water Test Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #21



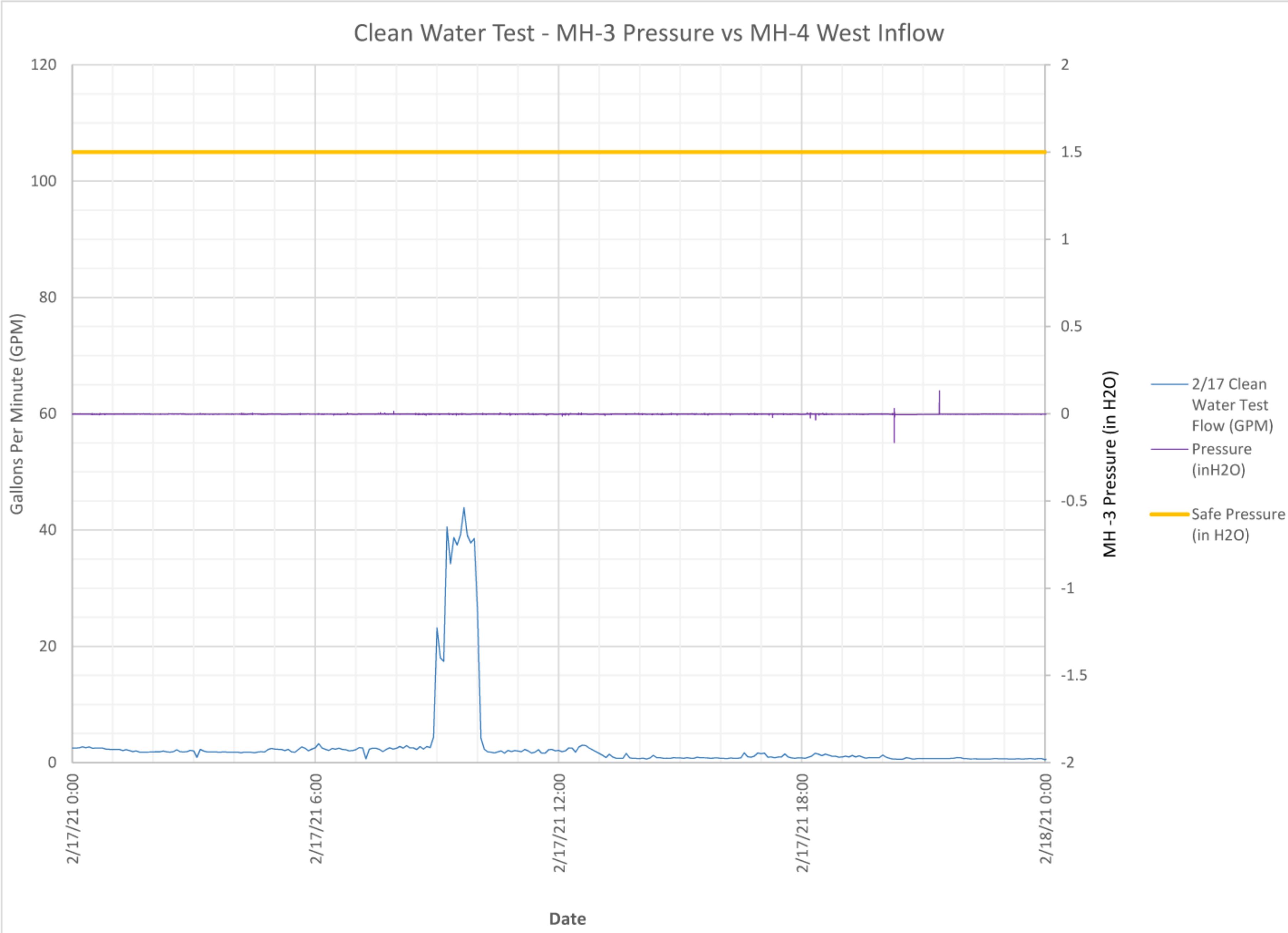
Clean Water Test - MH-2 Pressure vs MH-4 West Inflow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
MH-2 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
3/2/21 0:00
3/2/21 6:00
3/2/21 12:00
3/2/21 18:00
3/3/21 0:00
Date
3/2 Clean Water Test Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #22

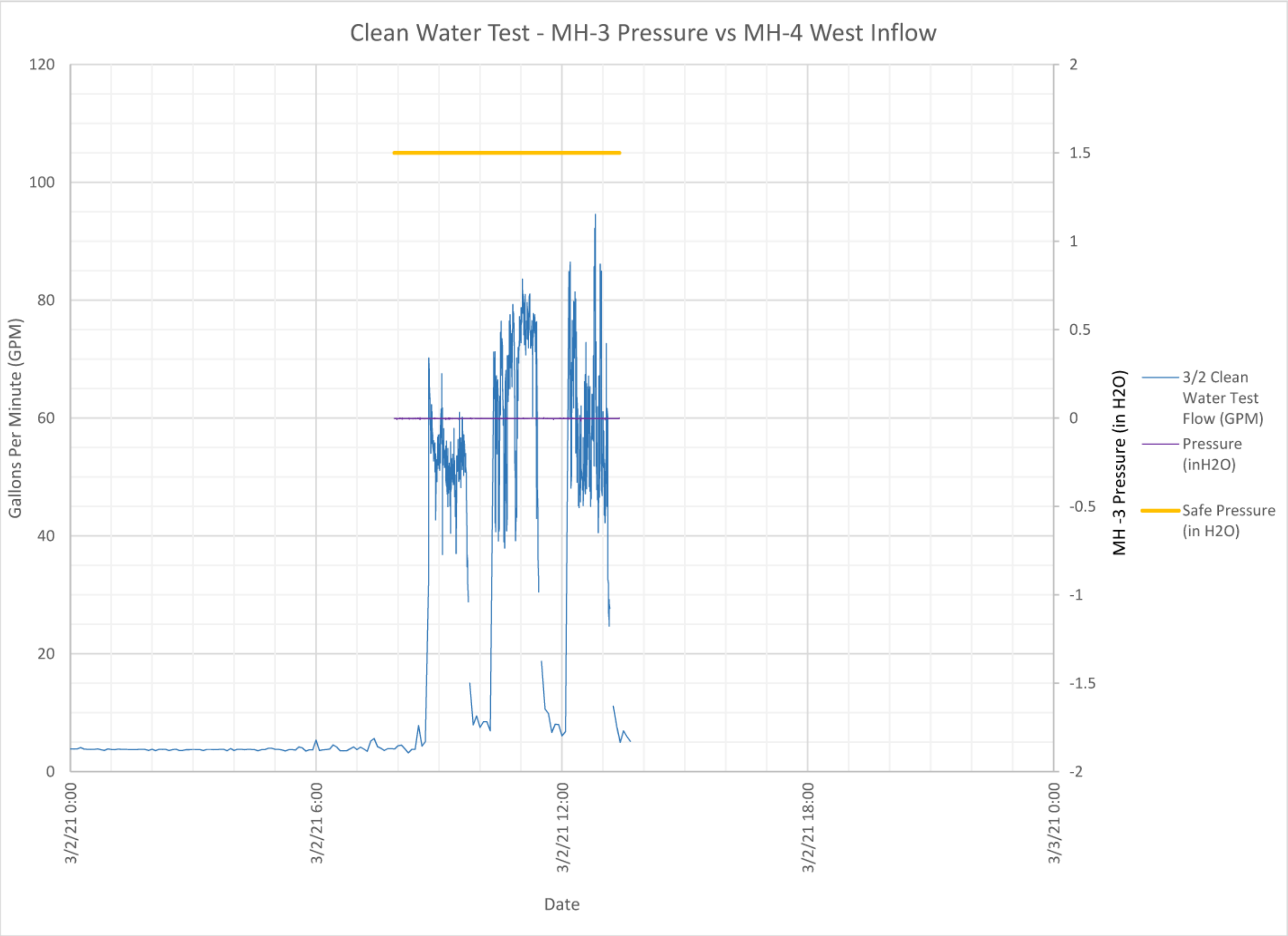


MH-3 Pressure vs MH-4 West Inflow
120
100
80
60
40
20
0
Gallons Per Minute (GPM)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
MH -3 Pressure (in H2O)
2/4/21 0:00
2/5/21 0:00
2/6/21 0:00
2/7/21 0:00
2/8/21 0:00
2/9/21 0:00
2/10/21 0:00
2/11/21 0:00
2/12/21 0:00
2/13/21 0:00
2/14/21 0:00
2/15/21 0:00
2/16/21 0:00
2/17/21 0:00
2/18/21 0:00
2/19/21 0:00
2/20/21 0:00
2/21/21 0:00
2/22/21 0:00
2/23/21 0:00
2/24/21 0:00
2/25/21 0:00
2/26/21 0:00
2/27/21 0:00
2/28/21 0:00
3/1/21 0:00
3/2/21 0:00
3/3/21 0:00
3/4/21 0:00
Date
Flow (GPM)
Pressure (inH2O)
Safe Pressure (in H2O)

GRAPH #23

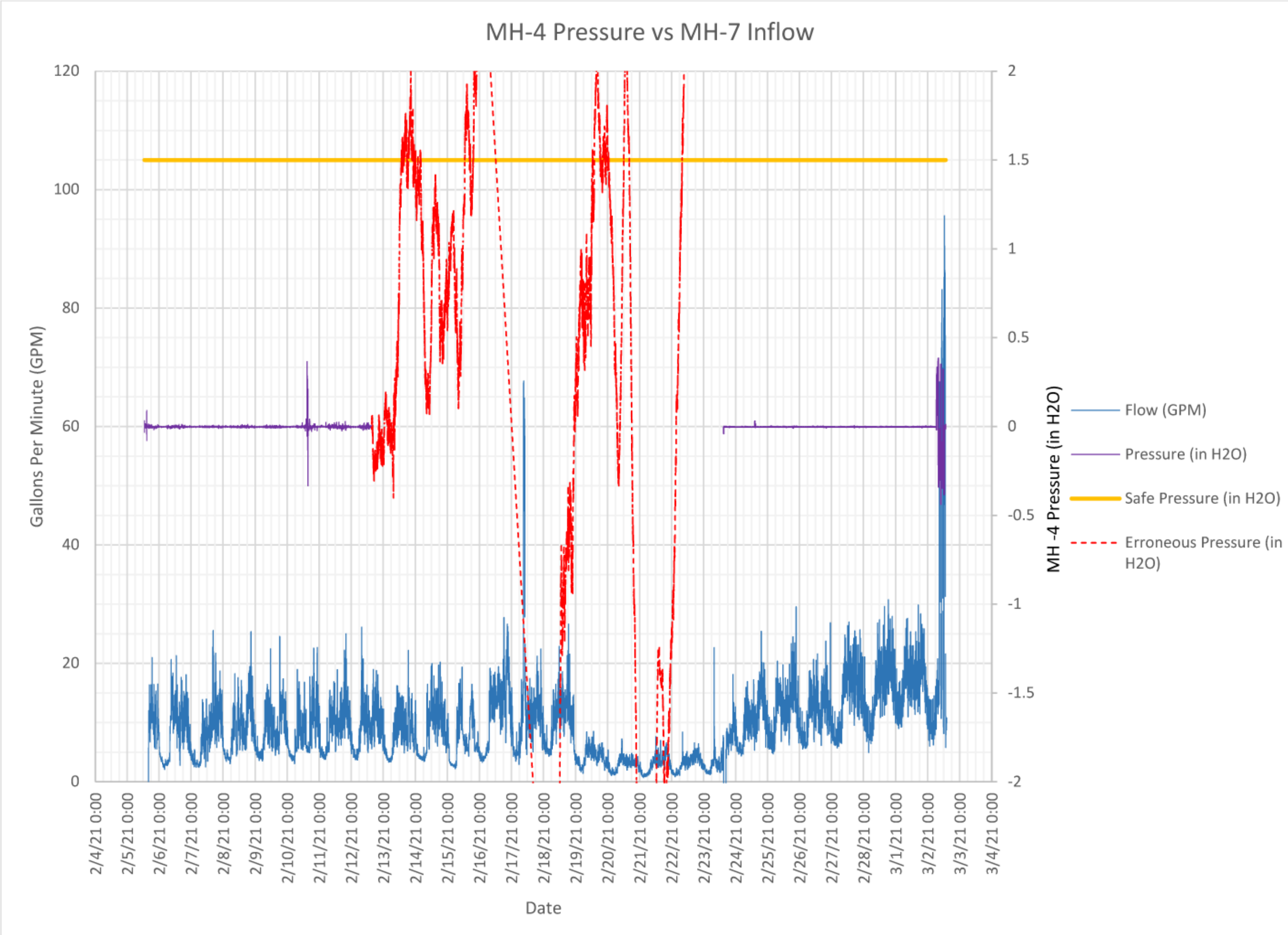

Clean Water Test - MH-3 Pressure vs MH-4 West Inflow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
MH -3 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
2/17/21 0:00
2/17/21 6:00
2/17/21 12:00
2/17/21 18:00
2/18/21 0:00
Date
2/17 Clean Water Test Flow (GPM)
Pressure (inH2O)
Safe Pressure (in H2O)

GRAPH #24



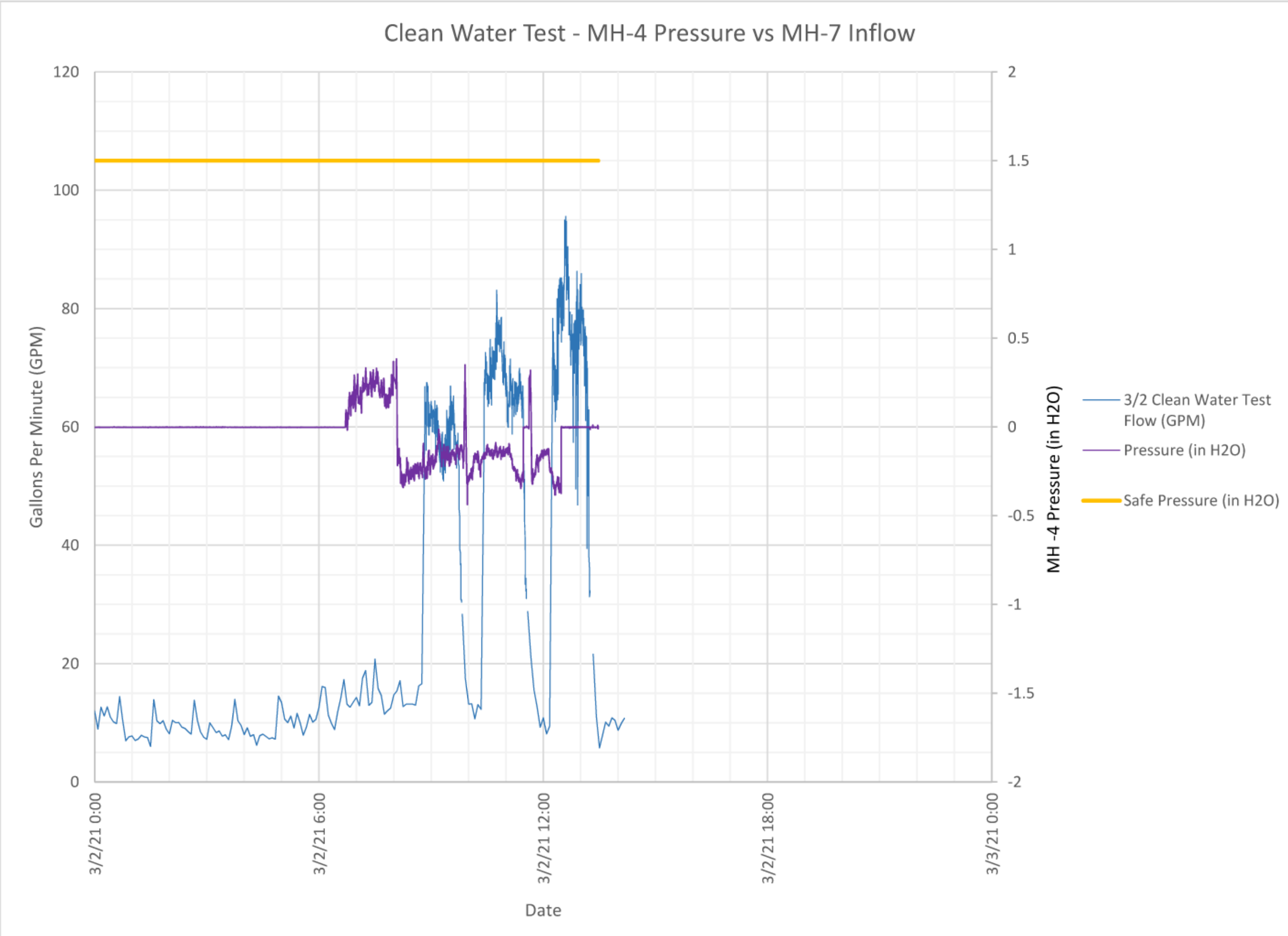
Clean Water Test - MH-3 Pressure vs MH-4 West Inflow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
MH -3 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
3/2/21 0:00
3/2/21 6:00
3/2/21 12:00
3/2/21 18:00
3/3/21 0:00
Date
3/2 Clean Water Test Flow (GPM)
Pressure (inH2O)
Safe Pressure (in H2O)

GRAPH #25



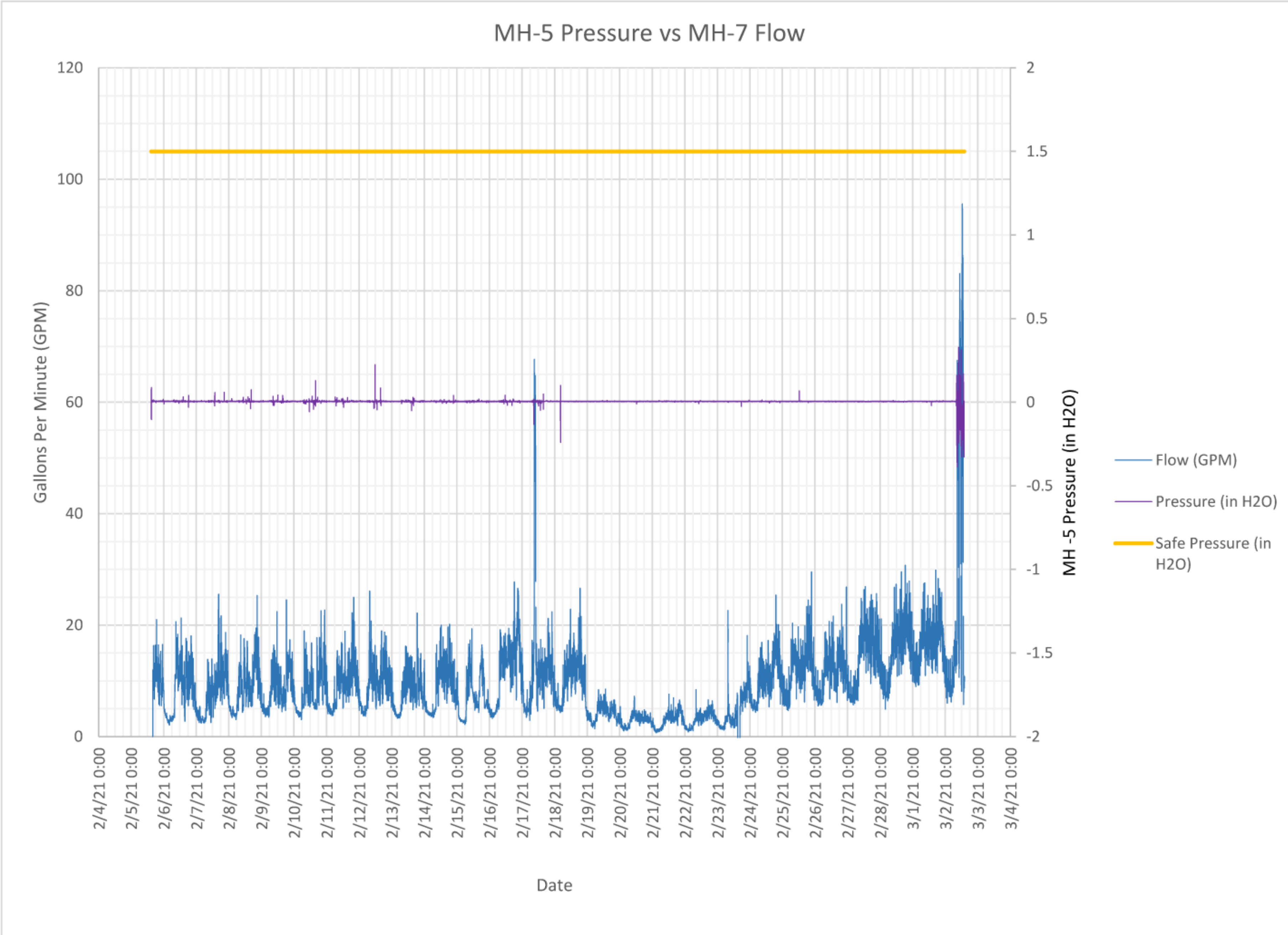
MH-4 Pressure vs MH-7 Inflow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
MH -4 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
2/4/21 0:00
2/5/21 0:00
2/6/21 0:00
2/7/21 0:00
2/8/21 0:00
2/9/21 0:00
2/10/21 0:00
2/11/21 0:00
2/12/21 0:00
2/13/21 0:00
2/14/21 0:00
2/15/21 0:00
2/16/21 0:00
2/17/21 0:00
2/18/21 0:00
2/19/21 0:00
2/20/21 0:00
2/21/21 0:00
2/22/21 0:00
2/23/21 0:00
2/24/21 0:00
2/25/21 0:00
2/26/21 0:00
2/27/21 0:00
2/28/21 0:00
3/1/21 0:00
3/2/21 0:00
3/3/21 0:00
3/4/21 0:00
Date
Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)
Erroneous Pressure (in H2O)

GRAPH #26



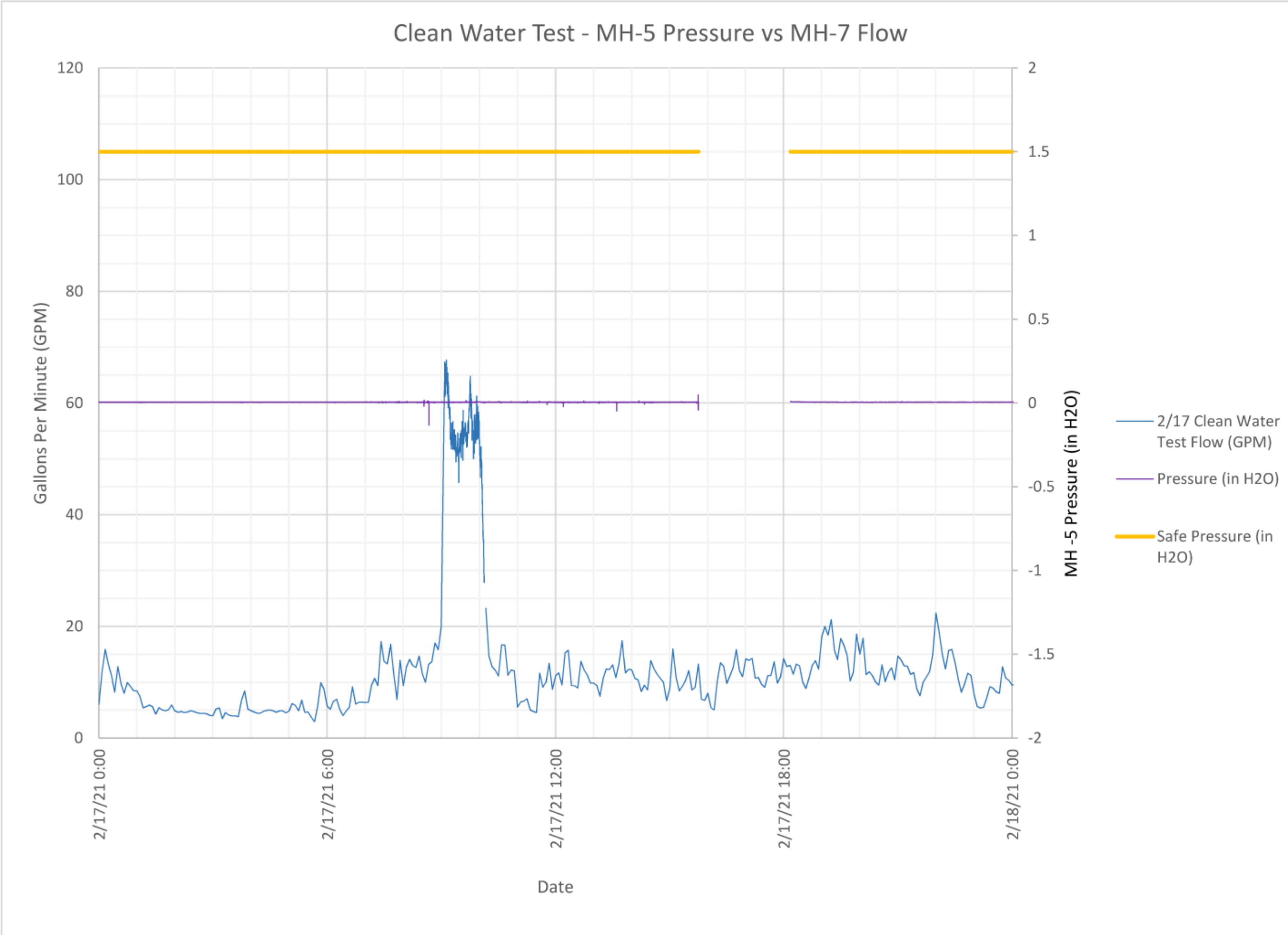
Clean Water Test - MH-4 Pressure vs MH-7 Inflow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
MH -4 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
3/2/21 0:00
3/2/21 6:00
3/2/21 12:00
3/2/21 18:00
3/3/21 0:00
Date
3/2 Clean Water Test Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #27



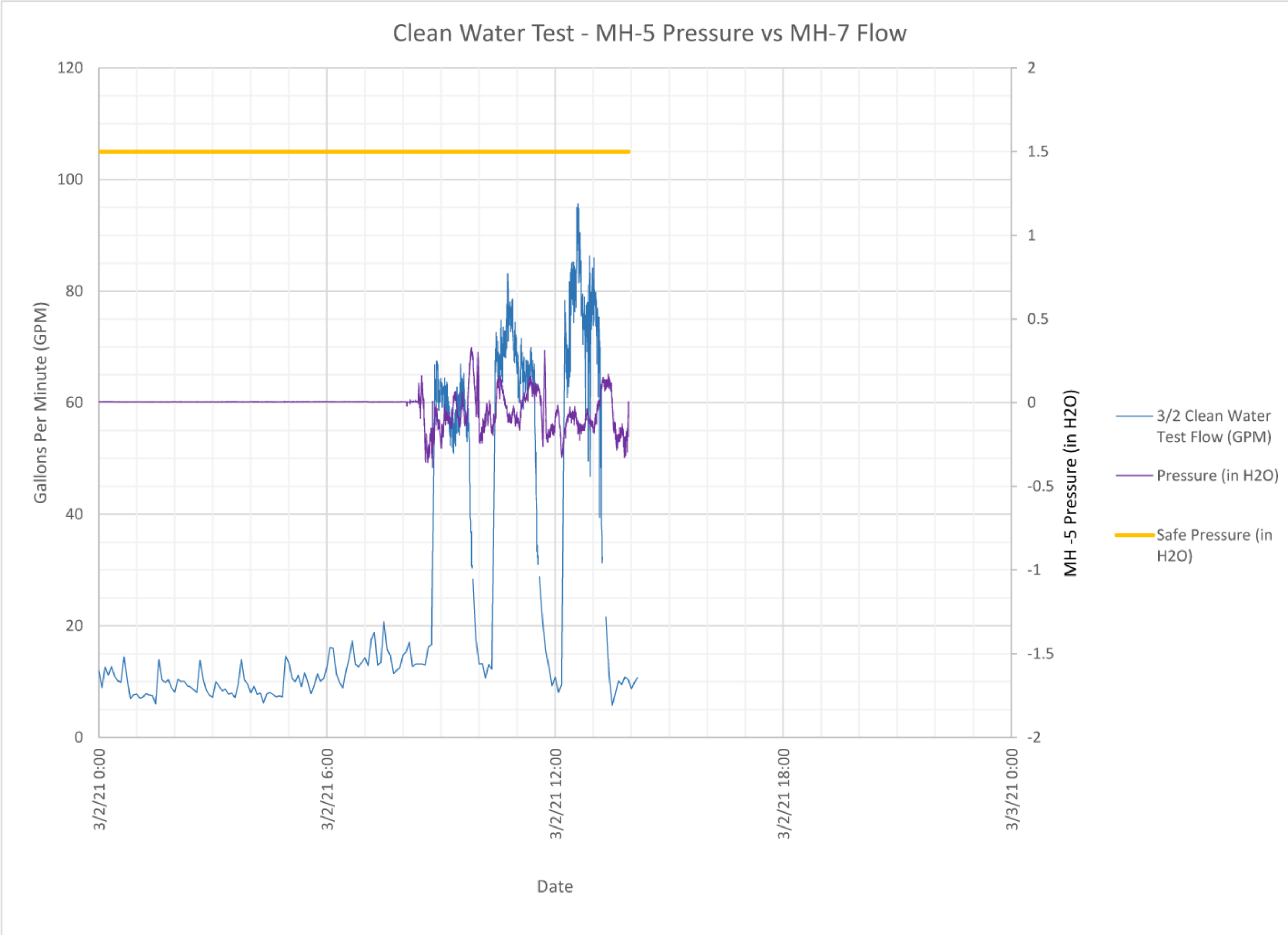
MH-5 Pressure vs MH-7 Flow
Gallons Per Minute (GPM)
MH -5 Pressure (in H2O)
Date
0
20
40
60
80
100
120
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2/4/21 0:00
2/5/21 0:00
2/6/21 0:00
2/7/21 0:00
2/8/21 0:00
2/9/21 0:00
2/10/21 0:00
2/11/21 0:00
2/12/21 0:00
2/13/21 0:00
2/14/21 0:00
2/15/21 0:00
2/16/21 0:00
2/17/21 0:00
2/18/21 0:00
2/19/21 0:00
2/20/21 0:00
2/21/21 0:00
2/22/21 0:00
2/23/21 0:00
2/24/21 0:00
2/25/21 0:00
2/26/21 0:00
2/27/21 0:00
2/28/21 0:00
3/1/21 0:00
3/2/21 0:00
3/3/21 0:00
3/4/21 0:00
Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #28



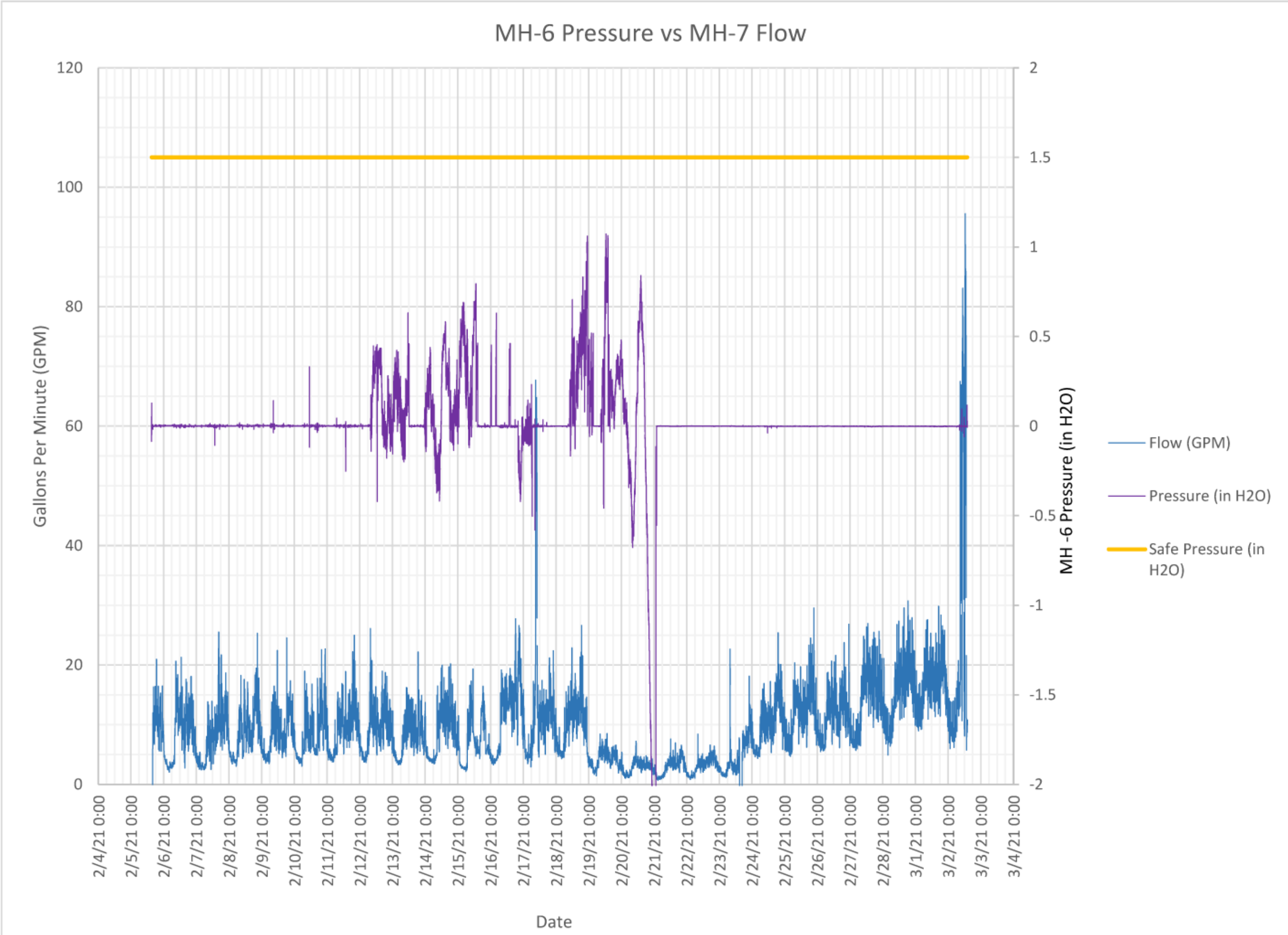
Clean Water Test - MH-5 Pressure vs MH-7 Flow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
MH -5 Pressure (in H2O)
2/17/21 0:00
2/17/21 6:00
2/17/21 12:00
2/17/21 18:00
2/18/21 0:00
Date
2/17 Clean Water Test Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #29



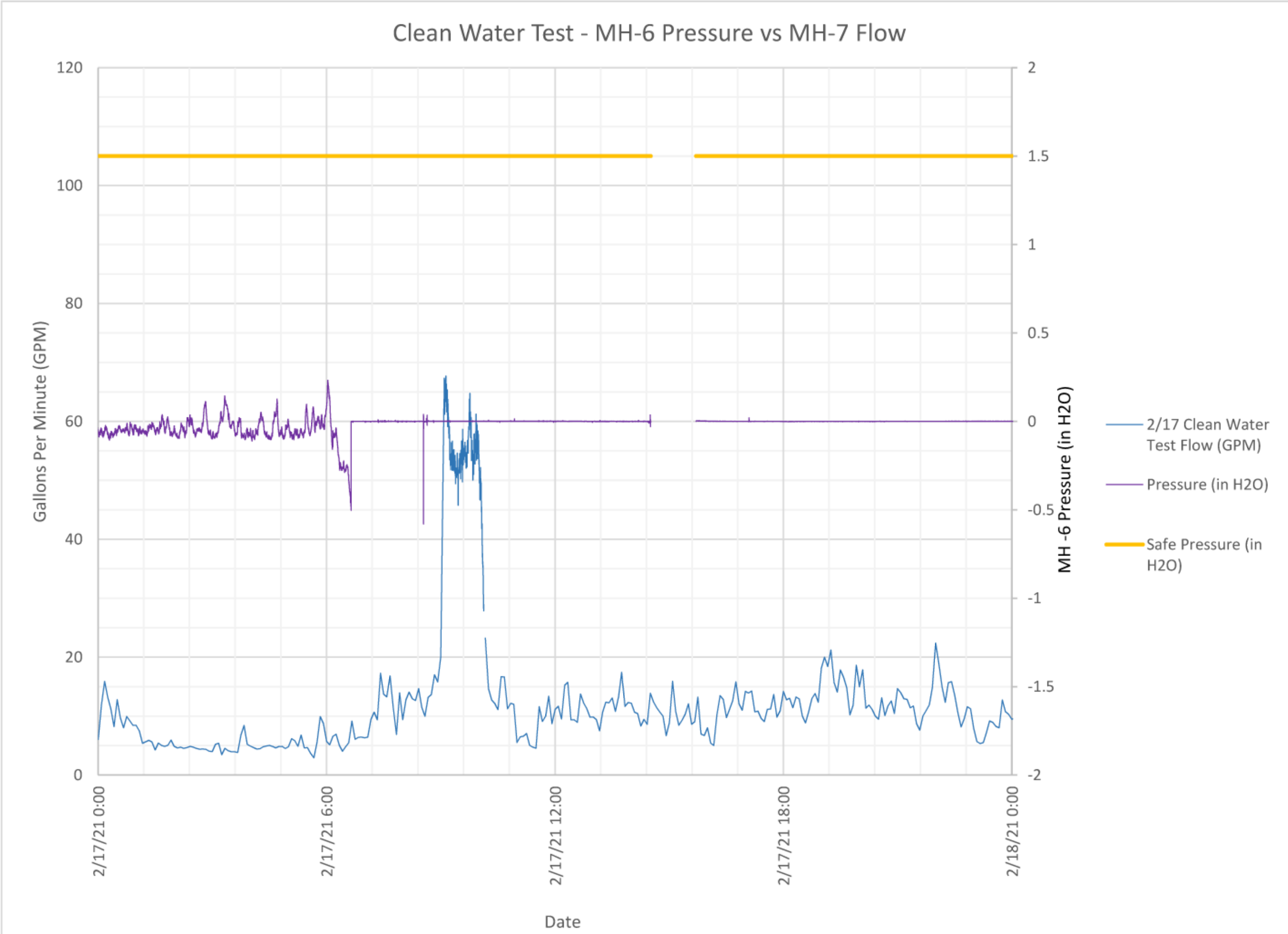
Clean Water Test - MH-5 Pressure vs MH-7 Flow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
MH -5 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
3/2/21 0:00
3/2/21 6:00
3/2/21 12:00
3/2/21 18:00
3/3/21 0:00
Date
3/2 Clean Water Test Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #30



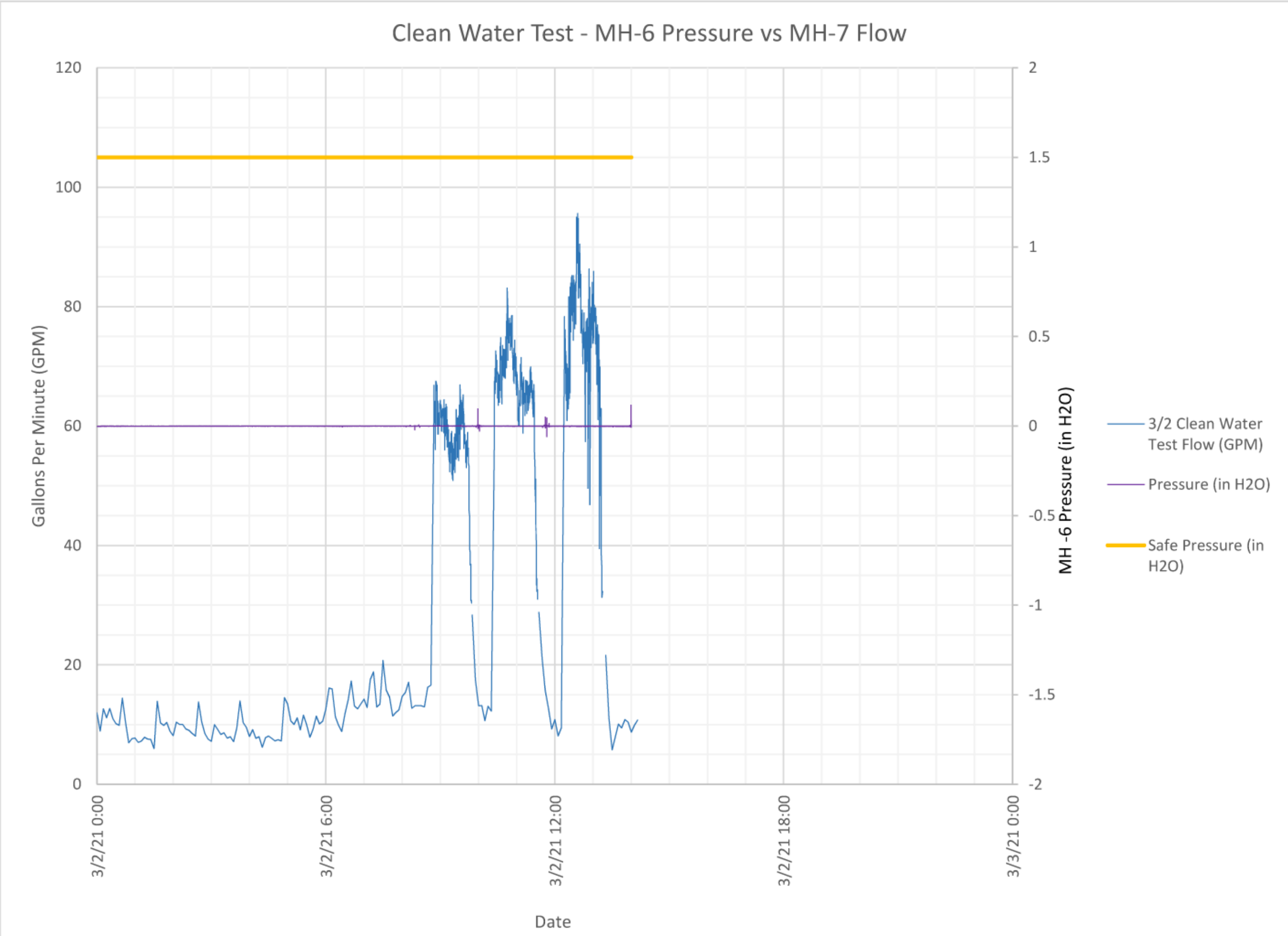
MH-6 Pressure vs MH-7 Flow
Gallons Per Minute (GPM)
MH -6 Pressure (in H2O)
Date
120
100
80
60
40
20
0
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
2/4/21 0:00
2/5/21 0:00
2/6/21 0:00
2/7/21 0:00
2/8/21 0:00
2/9/21 0:00
2/10/21 0:00
2/11/21 0:00
2/12/21 0:00
2/13/21 0:00
2/14/21 0:00
2/15/21 0:00
2/16/21 0:00
2/17/21 0:00
2/18/21 0:00
2/19/21 0:00
2/20/21 0:00
2/21/21 0:00
2/22/21 0:00
2/23/21 0:00
2/24/21 0:00
2/25/21 0:00
2/26/21 0:00
2/27/21 0:00
2/28/21 0:00
3/1/21 0:00
3/2/21 0:00
3/3/21 0:00
3/4/21 0:00
Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #31



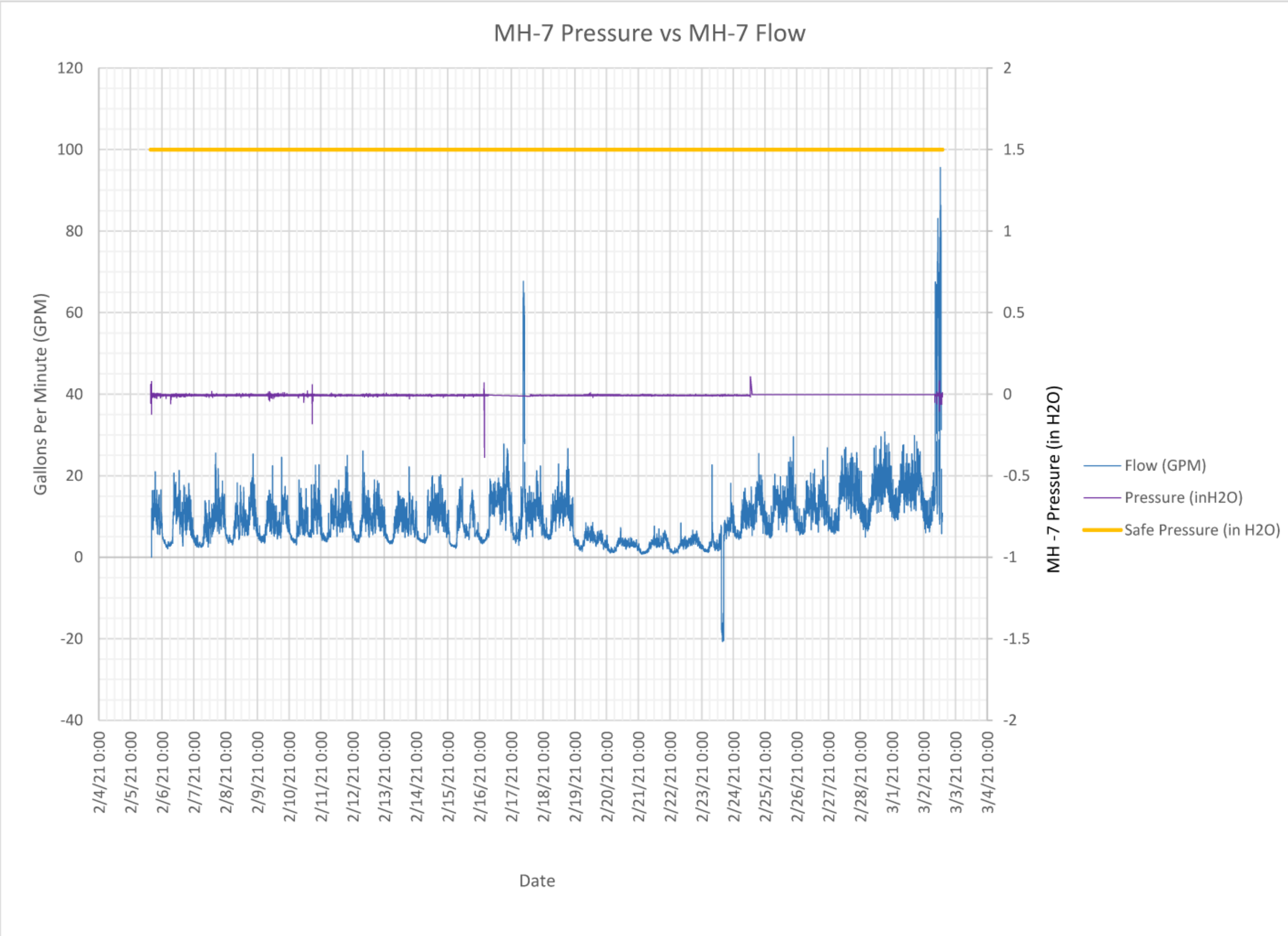
Clean Water Test - MH-6 Pressure vs MH-7 Flow
120
100
80
60
40
20
0
Gallons Per Minute (GPM)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
MH -6 Pressure (in H2O)
2/17/21 0:00
2/17/21 6:00
2/17/21 12:00
2/17/21 18:00
2/18/21 0:00
Date
2/17 Clean Water Test Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #32



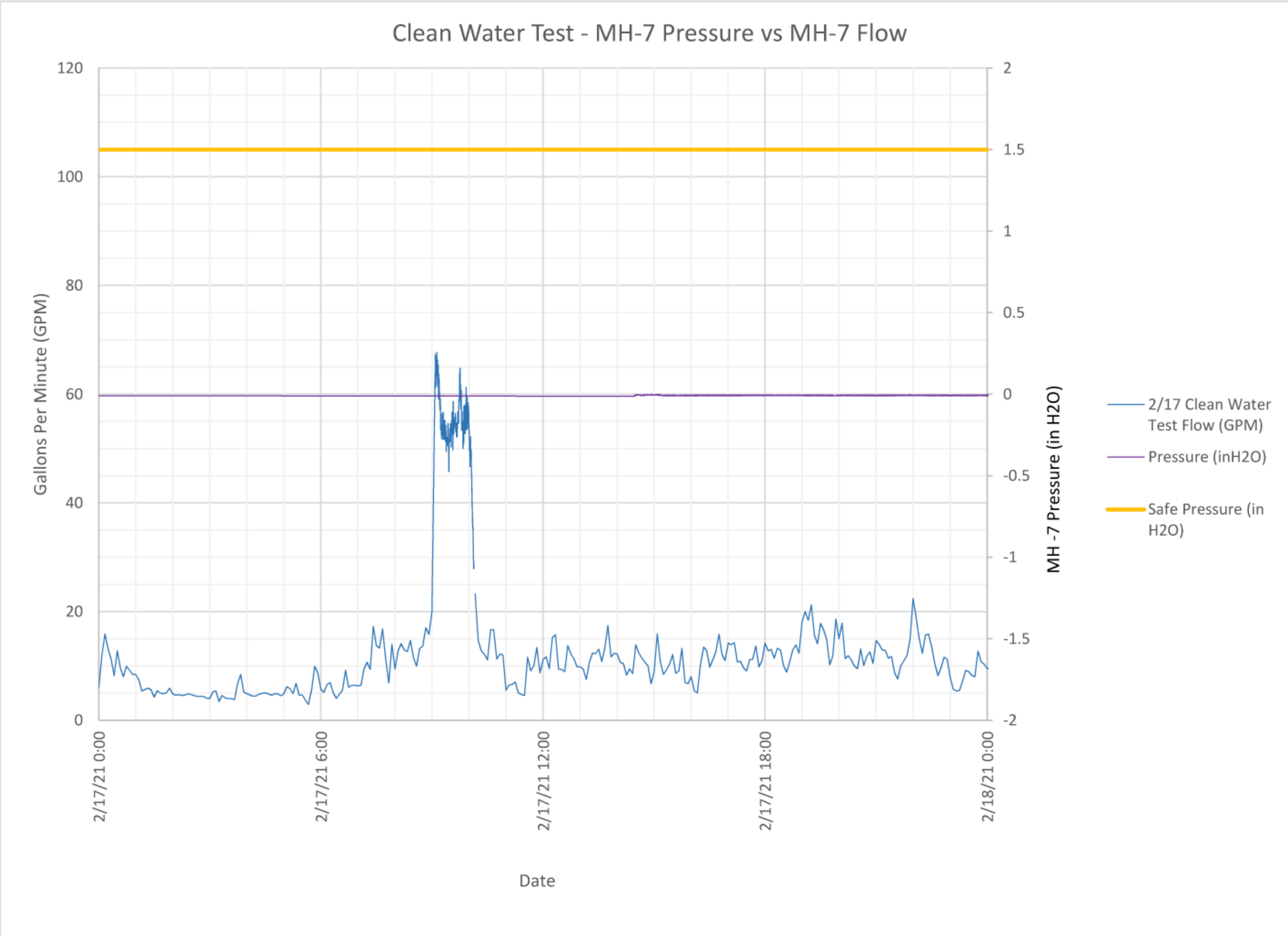
Clean Water Test - MH-6 Pressure vs MH-7 Flow
Gallons Per Minute (GPM)
MH -6 Pressure (in H2O)
120
100
80
60
40
20
0
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
3/2/21 0:00
3/2/21 6:00
3/2/21 12:00
3/2/21 18:00
3/3/21 0:00
Date
3/2 Clean Water Test Flow (GPM)
Pressure (in H2O)
Safe Pressure (in H2O)

GRAPH #33

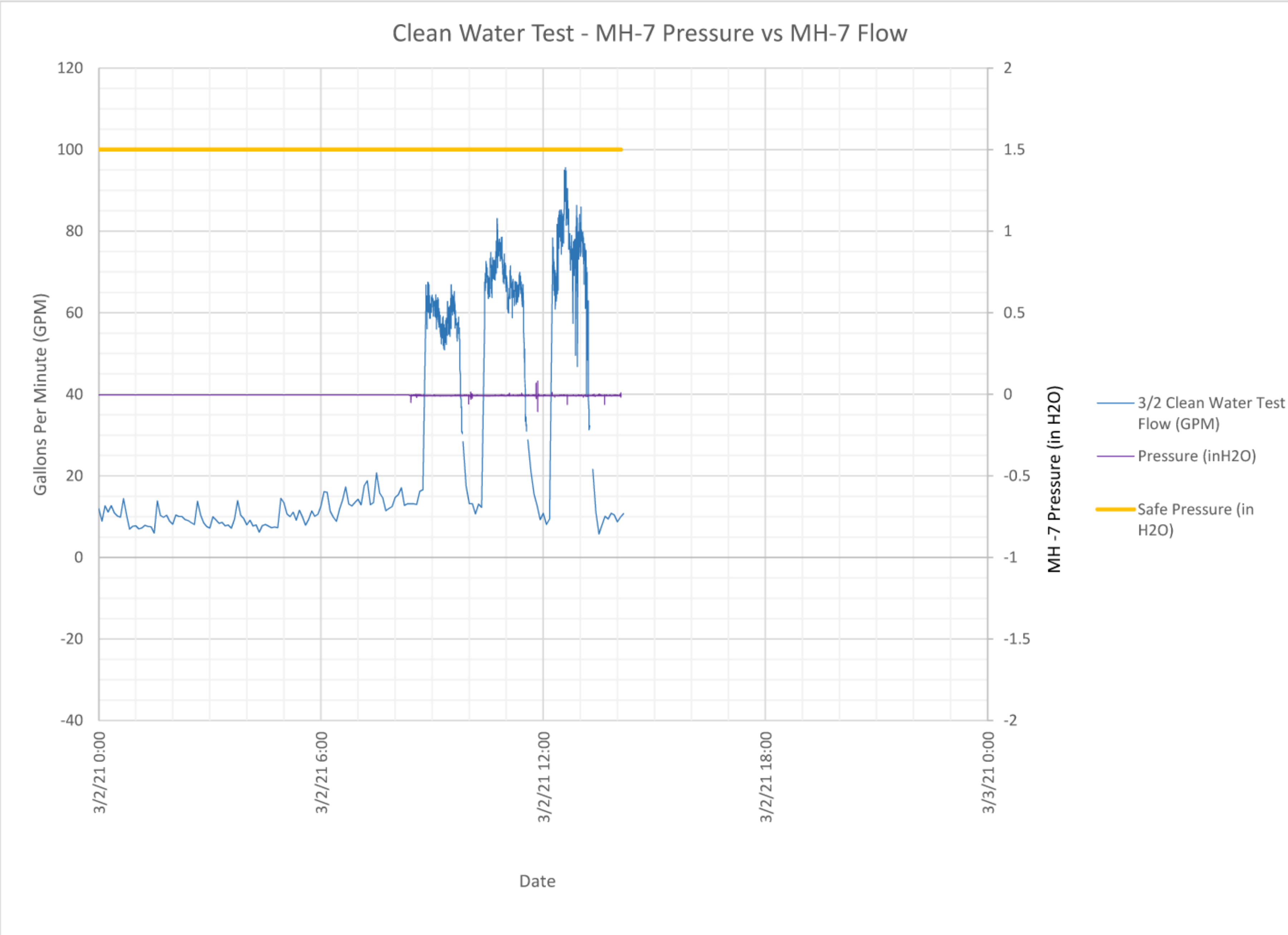


MH-7 Pressure vs MH-7 Flow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
-20
-40
MH -7 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
2/4/21 0:00
2/5/21 0:00
2/6/21 0:00
2/7/21 0:00
2/8/21 0:00
2/9/21 0:00
2/10/21 0:00
2/11/21 0:00
2/12/21 0:00
2/13/21 0:00
2/14/21 0:00
2/15/21 0:00
2/16/21 0:00
2/17/21 0:00
2/18/21 0:00
2/19/21 0:00
2/20/21 0:00
2/21/21 0:00
2/22/21 0:00
2/23/21 0:00
2/24/21 0:00
2/25/21 0:00
2/26/21 0:00
2/27/21 0:00
2/28/21 0:00
3/1/21 0:00
3/2/21 0:00
3/3/21 0:00
3/4/21 0:00
Date
Flow (GPM)
Pressure (inH2O)
Safe Pressure (in H2O)

GRAPH #34


Clean Water Test - MH-7 Pressure vs MH-7 Flow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
MH -7 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
2/17/21 0:00
2/17/21 6:00
2/17/21 12:00
2/17/21 18:00
2/18/21 0:00
Date
2/17 Clean Water Test Flow (GPM)
Pressure (inH2O)
Safe Pressure (in H2O)

GRAPH #35



Clean Water Test - MH-7 Pressure vs MH-7 Flow
Gallons Per Minute (GPM)
120
100
80
60
40
20
0
-20
-40
MH -7 Pressure (in H2O)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
3/2/21 0:00
3/2/21 6:00
3/2/21 12:00
3/2/21 18:00
3/3/21 0:00
Date
3/2 Clean Water Test Flow (GPM)
Pressure (inH2O)
Safe Pressure (in H2O)

ATTACHMENT G

Data Challenges

DATA CHALLENGES - FLOW METERS

Negative Flows

The flow meters occasionally display negative flow data; however, these data have been disregarded as the sewer records document that the sewers are sloping in the correct direction and there was not a large increase in depth which would indicate backflow conditions in the sewer. Furthermore, as documented in the flow meter's operation manual, the flow meters will provide less accurate velocity data when the level drops below 1 inch. In addition, when the liquid depth drops below 0.4 inches above the sensor the depth measurement will also be less accurate. Both of these conditions were present during the negative flow interval noted above. For additional information on specific instances of this occurring please see the Initial Background Memo.

Missing Flow Data

The MH-4 flow meter monitoring inflow liquids from the east (Launcelot Lane) did not record data after 2/10 at 3:40 PM and did not resume until 2/17 at 12:40 PM. This resulted in not having flow data recorded for a period of background monitoring as well as for the first clean water test on 2/17. This again happened in the afternoon of the 17th through part of the 19th. While this did not affect the performance of the sewer system or the effectiveness of the overall test, we are unable to document the residential flow being contributed to MH-4 from the east. However, the total flow for the residential sewer area was monitored and recorded at MH-7; therefore, it was not necessary to re-perform the initial 45 GPM test.

Landfill Flow Meter

On the first day of clean water injection testing, it was intended to use the landfill's leachate flow meter to verify flow rates to the sewer system during the clean water injection testing. However, this meter had not been used since leachate discharging to the sewer system was discontinued in September 2020 and the meter was not functional during the initial clean water testing on 2/17. The clean water test did proceed by using an in-line flow meter on the hose between the fire hydrant and BFI's discharge piping. The flows in the sewer system were also recorded with the MH-4 west and MH-7 flow meters. A new permanent leachate flow meter, factory calibrated and certified, was installed prior to the clean water injection testing performed on 3/2.

Firehose Flow Meter

The in-line flow meter connected to the firehose during the initial clean water testing on 2/17 was relied upon since the Landfill's flow meter was reading incorrectly during the test. Once the flow meter data from MH-4 west and MH-7 were collected from the sewer system, the documented flow from the testing period was well below the 45 GPM rate that was the intended injection rate. After observing and considering additional clean water injection tests recorded flow rates it is likely that the temporary meters within the sewer system were underreporting total flows.

Low Flow Periods

As shown on Graph 3, MH-7 continuous flow records for the dates 2/19 through 2/23 indicate abnormally low flow levels when compared to data before and after this time period. For this reason, these data were excluded when calculating the diurnal curves. It is assumed that solids temporarily disturbed this sensor and that after the solids washed away, the meter started reading accurately.

Missing Pressure Data

As shown on Graph 19, pressure data in MH-2 was accidentally erased between 2/17 through 2/23 while attempting to download the pressure data; however, MH-1 pressure data in Graph 16 did not show any significant pressure readings during that period.

DATA CHALLENGES - PRESSURE TRANSDUCERS

Missing Pressure Readings

The pressure sensors in MH-4 and MH-7 both stopped recording on the morning of 2/16/21 at 4:17 AM and 6:43 AM respectively. This was not discovered until after the first clean water testing was performed. However, no other meter showed signs of a pressurization event during the clean water testing period.

It is unclear what caused the pressure sensors to stop reading and recording data in MH-4 and MH-7. It is suspected that the data logger may have run out of memory space and stopped logging data because it was not programmed to overwrite old data. Alternatively, condensation may have accumulated on the touch spring shutting the sensor off. Changes were made to address these two issues in the second round of testing. The memory issue was addressed by programming the sensor to delete all old data once downloaded and to overwrite the oldest data if space is not available. To prevent humidity from turning the meter off, the sensor was programmed to only turn off when a magnetic switch is used.

Erroneous Pressure Readings

The pressure sensor in MH-4 on 2/12 at 3:23 PM started displaying pressure variations that strayed from the normal background conditions. After the start of this event the pressure transducer recorded abnormally high and low pressures and never returned to background conditions. When comparing this sensor's abnormal pressure data to the flow records there was no abnormal flow events documented. In addition, the pressure sensors upstream and downstream did not detect any abnormal pressures during this period.

To further confirm this sensor was erroneous the sensors between MH-3 and MH-4 were swapped. The erroneous sensor continued to detect abnormal pressures in MH-3 while the sensor in MH-4 returned to background pressure conditions. A replacement sensor was sent to the site and installed prior to completing the second phase of clean water testing at the higher rates.

Therefore, accurate pressure data are unavailable for MH-4 from 2/12 at 3:23 PM until another operating sensor from MH-3 was placed in MH-4 on 2/23 at 2:56 PM. Since the faulty sensor was placed in MH-3, accurate pressure data are unavailable for MH-3 starting 2/23 at 2:59 PM and are unavailable until this sensor was replaced the morning of 3/2, prior to clean water testing performed that day.

Excessive Download Periods

Pressure sensors were originally formatted to monitor and record data at 1-second intervals. While this provided a significant amount of records (and clearly documented that excessive pressures were not being detected in the sewer system), the time required to download these data was excessive and would take an entire day to complete. In addition, this amount of data is challenging for computers and programs to process. As documented in the Initial Background Memo, the sensors were reprogrammed to only take a reading once every 15 seconds during the background monitoring periods. The sensors were then reprogrammed to resume readings at 1-second intervals during clean water injection testing and were returned to 15-second readings after testing was completed.

ATTACHMENT H

Site Layout

DATE: 4/7/21 FILE NAME: 13213023.00

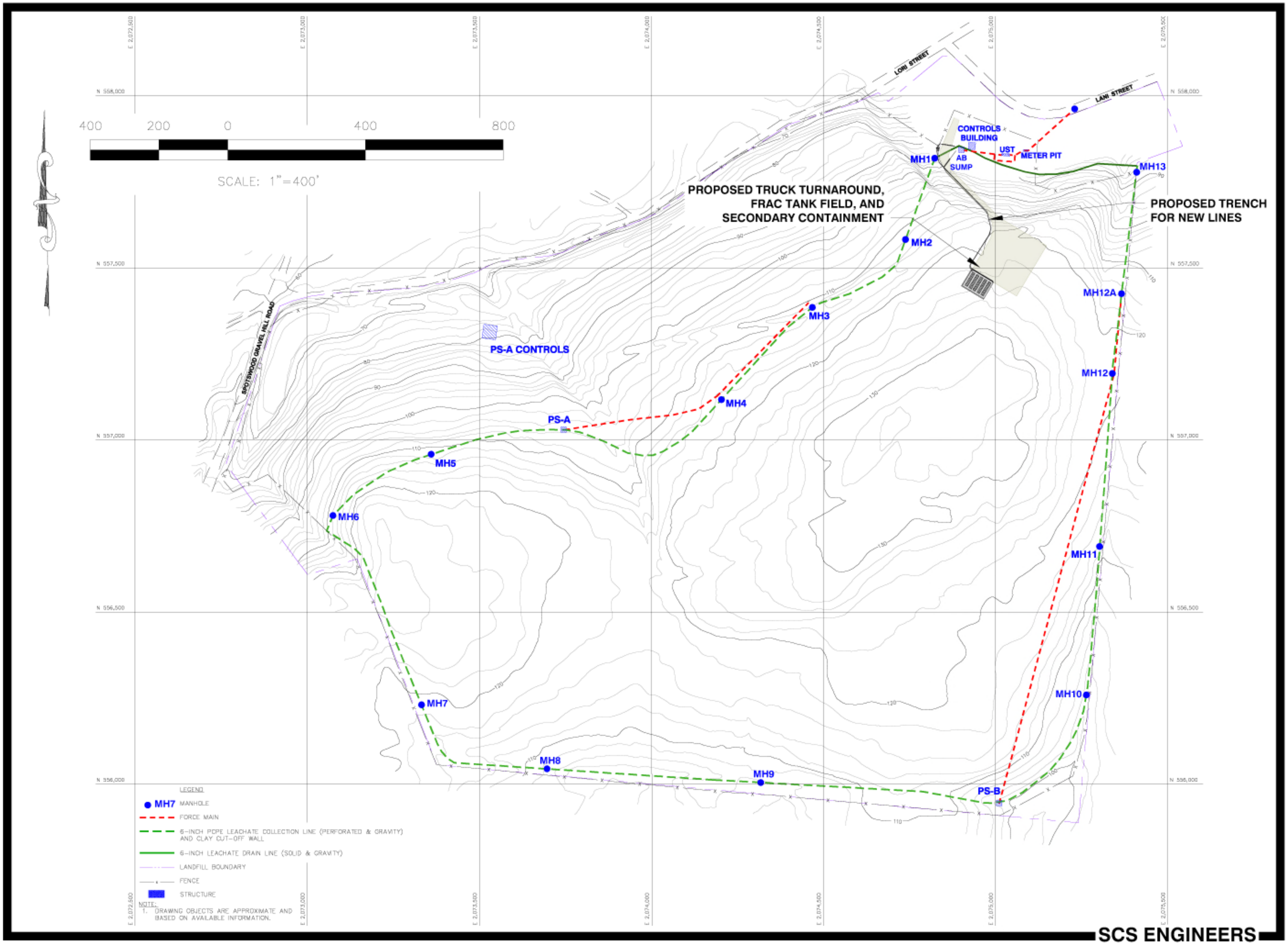
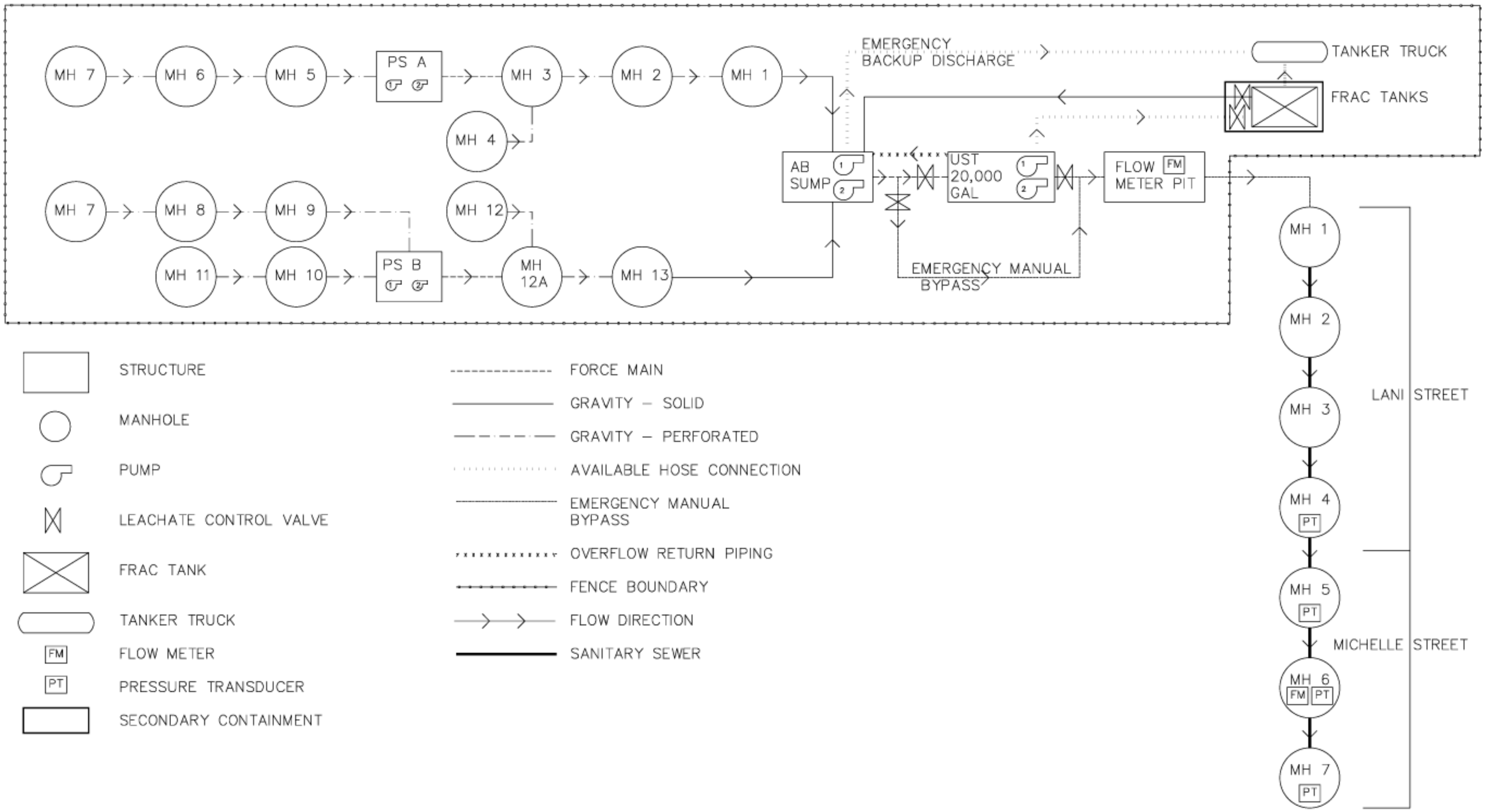


FIGURE 1 - SITE PLAN

ATTACHMENT I

Process and Instrumentation Diagram



NO.	REVISION	DATE

SHEET TITLE: MONROE TOWNSHIP LANDFILL 2021 PROPOSED SITE CONDITIONS

PROJECT TITLE: MONROE TOWNSHIP LANDFILL LEACHATE DISPOSAL

CLIENT

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS, INC.
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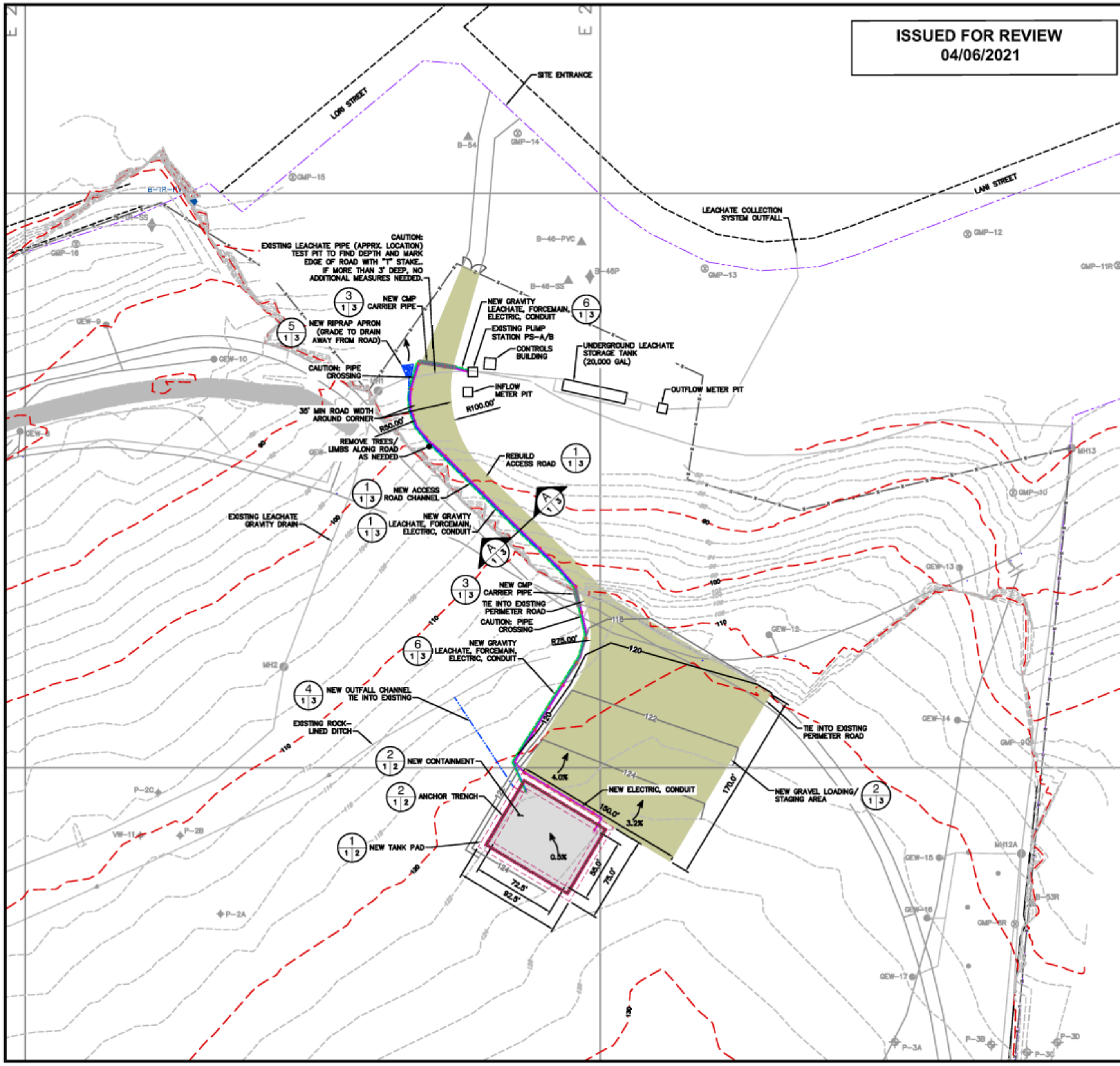
PROJ. NO. 13213023.00
DWN. BY: CWW

CADD FILE: MT LANDFILL
DATE: 4/7/21
SCALE: NTS
DRAWING NO. 2 of 2

ATTACHMENT J

Tank Containment and Road Improvements



ISSUED FOR REVIEW
04/06/2021

LEGEND

- EXISTING GAS MONITORING PROBE (GMP-6)
- MAGOTHY FORMATION MONITORING WELL
- PERCHED WATER ZONE WITHIN THE MAGOTHY FORMATION MONITORING WELL
- LANDFILL PROPERTY BOUNDARY LINE AND FENCE
- 7 FOOT HIGH CYCLONE FENCE
- EXISTING ROAD
- EXISTING GRAVEL ROAD
- EXISTING 10 FOOT CONTOUR
- EXISTING 2 FOOT CONTOUR
- NEW FORCEMAIN (FM)
- NEW ELECTRIC LINE/CONDUIT (E)
- NEW COMMUNICATION LINES/CONDUIT
- NEW GRAVITY LEACHATE LINE
- NEW 10 FOOT CONTOUR
- NEW 2 FOOT CONTOUR

REFERENCES

1.) TOPOGRAPHY TAKEN FROM DRAWING PROVIDED BY ENGINEERING TECHNOLOGIES ASSOCIATES, INC., DATED JULY 29, 1986, WITH SUBSEQUENT MODIFICATIONS BY BROWNING-FERRIS WASTE SYSTEMS OF NEW JERSEY, INC., AND ENVIRONMENTAL RESOLUTIONS, INC., DATE APRIL 22, 2013. HORIZONTAL DATUM IS THE N.J. STATE PLANE COORDINATE SYSTEM (NAD 83). CONTOUR INTERVAL SHOWN IS 2 FEET.

2.) LOCATIONS OF EXISTING ENGINEERED SYSTEMS TAKEN FROM THE FOLLOWING SOURCES: SUPPLEMENTAL ENVIRONMENTAL INVESTIGATION, MONROE TOWNSHIP LANDFILL, MIDDLESEX COUNTY, NEW JERSEY, PREPARED BY PAUL C. RIZZO ASSOCIATES, INC., DECEMBER 1991. FINAL REPORT RECORD DOCUMENTATION, MONROE TOWNSHIP LANDFILL, CLOSURE CAP DISRUPTION, PREPARED BY GOLDER CONSTRUCTION SERVICES, INC., JUNE 1993. FINAL RECORD DOCUMENTATION REPORT, CONSTRUCTION QUALITY ASSURANCE SERVICES, LANDFILL GAS SYSTEM EXPANSION, MONROE TOWNSHIP, MIDDLESEX TOWNSHIP, JAMESBURG, NEW JERSEY, PREPARED BY GOLDER CONSTRUCTION SERVICES, INC., OCTOBER 1995. AS-BUILT RECORD DOCUMENTATION TITLED "BROWNING - FERRIS GAS SERVICES, INC., LANDFILL GAS MIGRATION CONTROL SYSTEM, MONROE TOWNSHIP LANDFILL, MIDDLESEX COUNTY, NEW JERSEY," PREPARED BY ORGANIC WASTE TECHNOLOGIES, INC., JULY 1995.

3.) ADJUST GRADING IN THE FIELD AS NEEDED. MAINTAIN MINIMUM SLOPES AND COVER REQUIREMENTS AS NOTED ON THE PLANS.

0 40 80 120
SCALE IN FEET

NO.	REVISION	DATE

SHEET TITLE: SITE PLAN

PROJECT TITLE: MONROE TOWNSHIP LANDFILL TANK RELOCATION

CLIENT: BFI WASTE SERVICES OF NJ, INC.
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PHOENIX, AZ 85054

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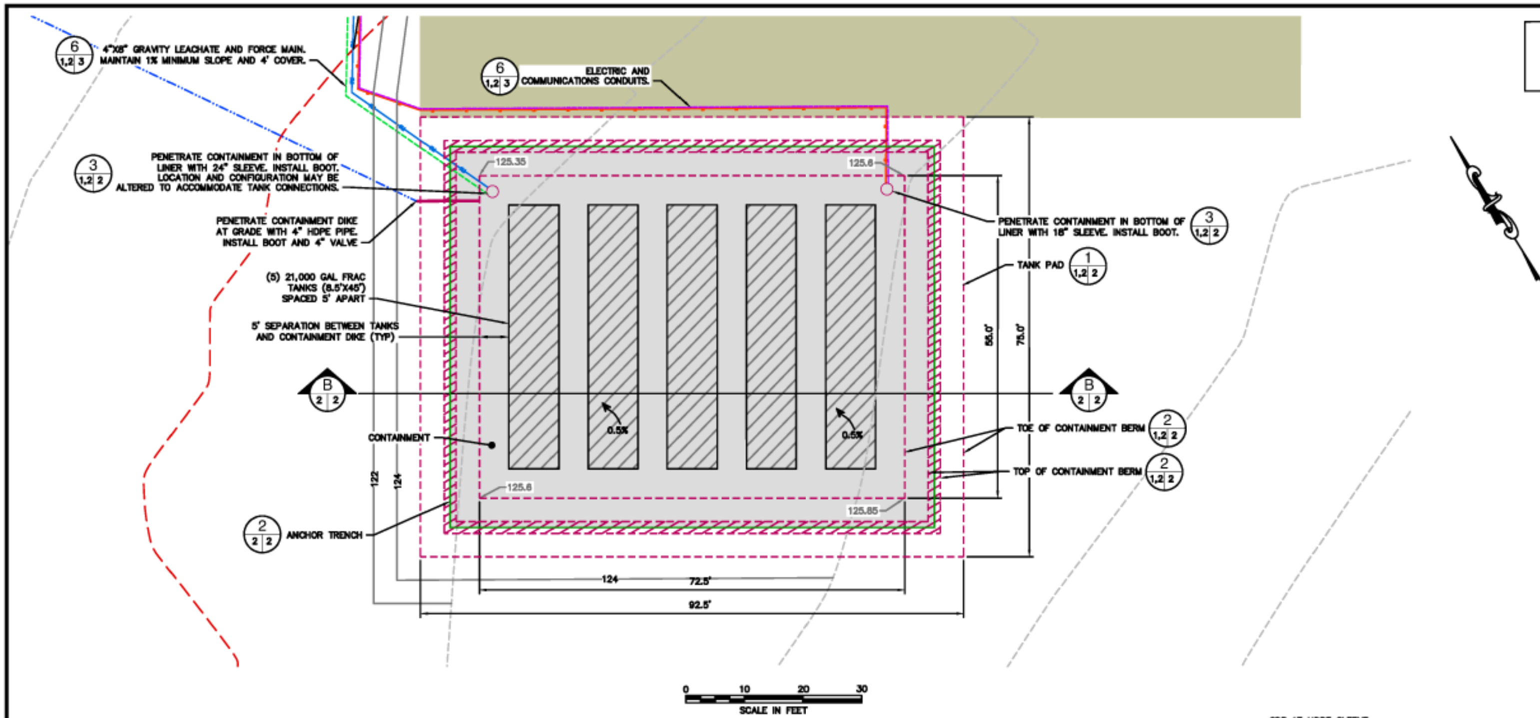
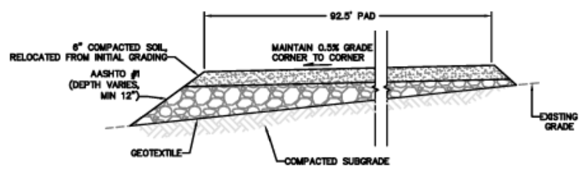
PROJ. NO. 13213023.00 | DWN. BY AMC/CMW | CHK. BY ERP

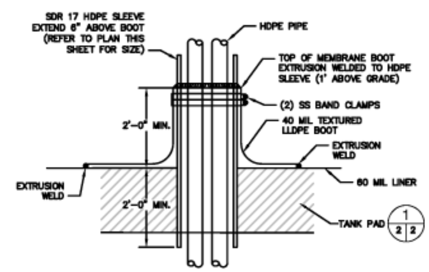
CADD FILE: MONROE LANDFILL
DATE: MARCH 2021
SCALE: 1"=40'
DRAWING NO. 1 of 3

ISSUED FOR REVIEW
04/06/2021

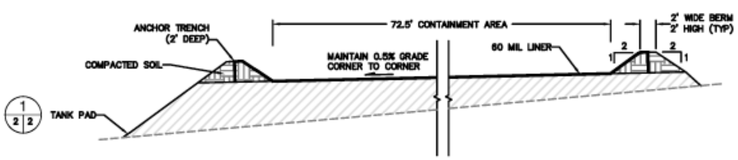




TANK PAD DETAIL
SECTION B–B
NO SCALE



CONTAINMENT PENETRATION DETAIL
NO SCALE



CONTAINMENT DETAIL
SECTION B–B
NO SCALE

NO.	REVISION	DATE

SHEET TITLE
TANK PAD / DETAILS

PROJECT TITLE
MONROE TOWNSHIP LANDFILL
TANK RELOCATION

CLIENT
BFI WASTE SERVICES OF NJ, INC.
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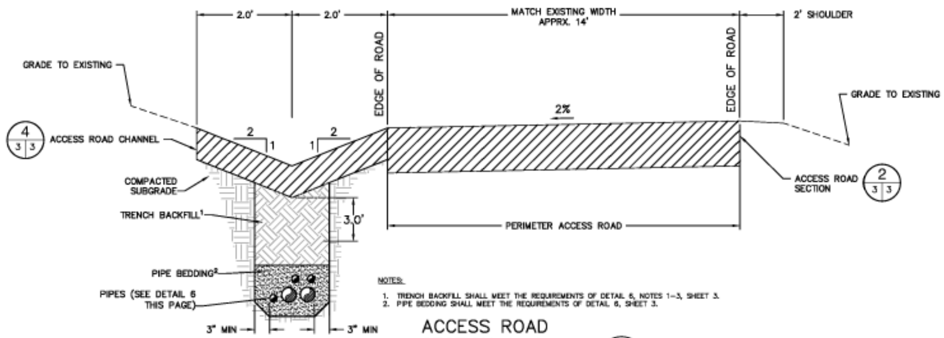
PROJ. NO. 13213023.00
DWN. BY AMC/CMW
CHK. BY ERP
Q/A RVW BY
APP. BY

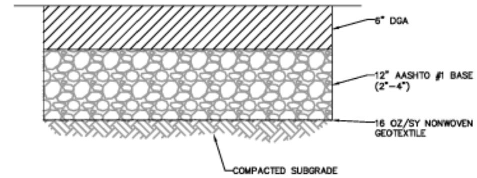
CADD FILE: MONROE LANDFILL
DATE: MARCH 2021
SCALE: AS NOTED
DRAWING NO. 2 of 3



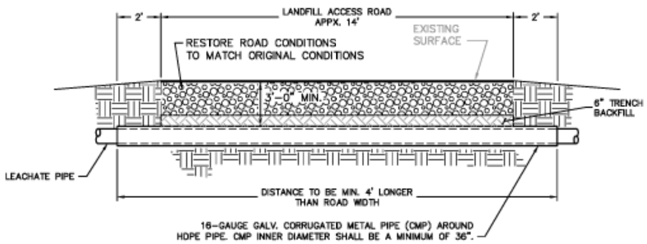
NOTES:

1. TRENCH BACKFILL SHALL MEET THE REQUIREMENTS OF DETAIL 6, NOTES 1–3, SHEET 3.
2. PIPE BEDDING SHALL MEET THE REQUIREMENTS OF DETAIL 6, SHEET 3.

ACCESS ROAD SECTION A–A (1 | 1 | 3)
NOT TO SCALE



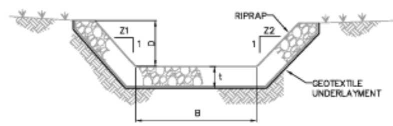
ACCESS ROAD & LOADING/ STAGING AREA DETAIL (2 | 1,2,3 | 3)
NO SCALE



NOTES:

1. MAINTAIN MINIMUM PIPE SLOPES FOR PROPER DRAINAGE

ROAD CROSSING DETAIL (3 | 1 | 3)
NO SCALE

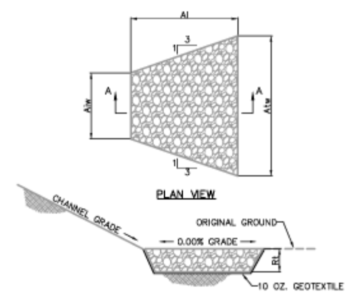


(LOOKING DOWNSTREAM)
CHANNEL CROSS–SECTION

CHANNEL NO.	STATIONS	BOTTOM WIDTH B (FT)	DEPTH D (FT)	Z1 (FT)	Z2 (FT)	RIPRAP GRADATION (R–_)	RIPRAP DEPTH t (IN)	UNDERLAYMENT
ACCESS ROAD	ALL	0	1	2	2	3*	9	10 OZ GEOTEXTILE
TANK PAD	ALL	0	1	2	2	3*	9	10 OZ GEOTEXTILE

*SMALL BLOCK FLEXAMAT OR 60 MIL MEMBRANE CHANNEL LINING MAY BE SUBSTITUED FOR R–3 RIPRAP. IF 60 MIL MEMBRANE IS USED, THE 10 OZ GEOTEXTILE UNDERLAYMENT MAY BE OMITTED AND CHECK DAMS INSTALLED EVERY 60' (SEE DETAIL 7 THIS SHEET).

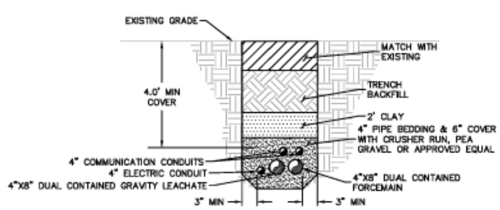
CHANNEL DETAIL (4 | 1,2,3 | 3)
NO SCALE



CHANNEL	RIPRAP		APRON		
	SIZE R–_	THICK. Rt (IN)	LENGTH Al (FT)	INITIAL WIDTH Aiw (FT)	TERMINAL WIDTH Atw (FT)
ACCESS RD	3	9	10	4	10

NO SCALE

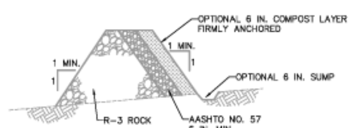
RIPRAP APRON DETAIL (5 | 1 | 3)



NOTES:

1. TRENCH BACKFILL SHALL BE INORGANIC SOIL, THAT IS NOT EXCESSIVELY WET OR SATURATED, FREE OF STONE, ROCK OR GRAVEL LARGER THAN 3 INCHES IN ANY DIMENSION, AND FREE OF DEBRIS, WASTE, FROZEN MATERIALS, VEGETATION, ORGANIC MATERIALS, ROOTS, AND OTHER DELETERIOUS MATTER. INCLUDES GW, GP, GM, GC, SW, SP, SM, SC, CL, OR CH MATERIALS. LIMIT OF PLASTICITY WILL BE LESS THAN 30 AND THE ORGANIC CONTENT WILL BE LESS THAN 5%.
2. BACKFILL SHALL BE PLACED IN 12" LIFTS AND COMPACTED TO 95% OF STANDARD PROCTOR +/– 2% OF OPTIMUM MOISTURE CONTENT.
3. CONTRACTOR SHALL KEEP SURFACE OR GROUND WATER FROM ACCUMULATING IN THE TRENCH DURING EXCAVATION, PIPE PLACEMENT AND GRAVEL BACKFILLING PROCEDURES.
4. INSTALL PULL LINES IN CONDUITS.
5. MAINTAIN 2' OF SEPARATION BETWEEN ELECTRIC LINE AND COMMUNICATION LINES.

PIPE TRENCH DETAIL (6 | 1,2 | 3)
NO SCALE



CROSS–SECTION

CHECK DAM DETAIL (7 | 3 | 3)
NO SCALE

ISSUED FOR REVIEW
04/06/2021

NO.	REVISION	DATE

SHEET TITLE: DETAILS

PROJECT TITLE: MONROE TOWNSHIP LANDFILL TANK RELOCATION

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PROJ. NO. 13213023.00 | DWN. BY: AMC/CMW | Q/A RVW BY:
DSN. BY: | CHK. BY: ERP | APP. BY:

CADD FILE: MONROE LANDFILL
DATE: MARCH 2021
SCALE: AS NOTED
DRAWING NO. **3** of 3